The Journal of

Applied Psychology

Vol. IV DECEMBER, 1920 No. 4

EDITORS

JAMES P. PORTER
Clark University

WILLIAM F. BOOK
Indiana University

And a Board of Co-operating Editors

CLARK UNIVERSITY
WORCESTER MASS.
FLORENCE CHANDLER, Publisher

Entered as second class matter June 9, 1917, at the post office at Worcester, Mass. under the Act of March 3, 1879.

The Journal of Applied Psychology

CO-OPERATING EDITORS

W. V. BINGHAM, Carnegie Institute of Technology; JUNE E. DOWNEY, University of Wyoming; ROBERT H. GAULT, Northwestern University; WILLIAM HEALY, Baker Foundation, Juvenile Court, Boston; H. L. HOLLINGWORTH, Columbia University; JOSEPH JASTROW, University of Wisconsin; HERBERT S. LANGFELD, Harvard University; JAMES H. LEUBA, Bryn Mawr College; HENRY C. MCCOMAS, Princeton University; WALTER D. SCOTT, Northwestern University; C. E. SEASHORE, University of Iowa; DANIEL STARCH, University of Wisconsin; EDWARD K. STRONG, JR., George Peabody College for Teachers; L. M. TERMAN, Leland Stanford Jr. University; E. L. THORNDIKE, Columbia University; J. E. WALLACE WALLIN, Psycho-Educational Clinic, St. Louis; G. M. WHIPPLE, University of Michigan; HELEN THOMPSON WOOLLEY, Vocation Bureau, Cincinnati.

The scope of the JOURNAL OF APPLIED PSYCHOLOGY will include the following: (a) The application of psychology to vocational activities, such as law, art, public speaking, industrial and commercial work, and problems of business appeal. (b) Studies of individual mentalities, such as types of character, special talents, genius, and individual differences, including the problems of mental diagnosis and vocational prognosis (c) The influence of general environmental conditions, such as climate, weather, humidity, temperature; also such conditions aa nutrition, fatigue, etc. (d) The psychology of everyday activities, such as reading, writing, speaking, singing, playing games or musical instruments, sports, etc.

VOL. IV DECEMBER, 1920 No. 4

TABLE OF CONTENTS

EDWARD L. THORNDIKE. Equality in Difficulty of Alternative Intelligence Examinations 283
H. E. BURTT and G. F. ARPS. Correlation of Army Alpha Intelligence Test with Academic Grades in High Schools and Military Academies 289
ELLIOTT FROST. Should Psychology Bake Bread 294
HENRY C. LINK. A Further Development of Employment Psychology 306
ROBERT H. GAULT. Picture Completion 310
S. M. DERRICK. A Comparative Study of the Intelligence of Seventy-five White and Fifty-five Colored College Students by the Stanford Revision of the Binet-Simon Scale 316
HENRY FOSTER ADAMS. The Effect of Climax and Anticlimax Order of Presentation on Memory 330
ARTHUR S. OTIS. The Selection of Mill Workers by Mental Tests 339
E. LEIGH MUDGE. The Common Synaesthesia of Music 342
JOHN E. ANDERSON. A Comparison of Two Methods of Giving the Number Series Completion Test 346
A. A. ROBACK. The Applied Psychology of Names 348
EDNA GORDON and H. J. BAKER. Intelligence Tests and Academic Standing 361
SYBIL MARSH GIBSON. A Decision Study of One Hundred and Fifty Young Men and Women 364
BOOK REVIEW 375

Communications, manuscripts, reviews, summaries, notices, books and off-prints for review should be addressed to Dr. James P. Porter, Clark University, Worcester, Mass. Contributors are requested to follow the conventional method of citation employed by this JOURNAL; in every case the year, volume and pages should be specified.

THE JOURNAL OF APPLIED PSYCHOLOGY is published quarterly. The subscription price is $4.00 a year. Single numbers $1.25. Remittances and business communications should be addressed to Florence Chandler, Publisher, Clark University, (950 Main St.), Worcester, Mass.

THE
JOURNAL OF APPLIED PSYCHOLOGY

VOL. IV DECEMBER, 1920 No. 4

EQUALITY IN DIFFICULTY OF ALTERNATIVE INTELLIGENCE EXAMINATIONS.

By EDWARD L. THORNDIKE, Teachers' College, Columbia University

In investigations made to secure equal difficulty in the alternative forms of the Intelligence Examination arranged by the writer for use by Columbia College and other institutions, certain facts of general interest have been found, which I report at this time.

One element of the examination is a 12 page team of 13 tests, containing 144 tasks in all. There are 15 forms of this. They were made somewhat hastily from the harder tasks of some of the Army Alpha tests, and other tests known to correlate well with intelligence, extended by similar tasks improvised by Dr. A. L. Rogers, Dr A. I. Gates, the writer, and others. No great care was given to making the 15 corresponding tasks, or even the 15 corresponding tests, equal in difficulty. Only that was done that could be done by common-sense measures without using up much time or money in experimentation. There was in fact no time available in the case of the original use of these tests (the selection of officer material in the Air Service of the United States Army.) The degree to which the 15 forms are equal in difficulty thus measures the result that may be expected in 15 forms of a 30-minute examination of 144 items, arranged with common-sense precautions.

Ten of the fifteen forms are nearly enough equal for any purpose to which such examinations are likely to be put. A, E, J, L and N are approximately equal; C and I are about 1% easier; F, K, and M are about 1% harder; H is about 3% easier; D about 5% easier; G and O are about 2½% harder; B is about 5% harder. These estimates may be in error in respect to single forms, but the general drift is substantially cor-

rect. One of the quickest, and probably one of the cheapest, ways to get any given number of alternative examinations of approximately equal difficulty, is to make about 1½ times as many as will be needed, as nearly equal as common-sense procedures can make them, test all, and retain those which are up to specifications. The equality thus secured is a genuine equality of the different forms as they are actually used.

For most uses of these examinations only one of the fifteen need be discarded, since it is wise in general to use two forms together to make one hour of this sort of work. Seven such pairs differing as pairs by only 1% in difficulty can be had. These seven sets of two each thus furnish a convenient instrument for repeated measurements of the same individuals, or for the comparison of groups where there is danger that there may be gossip concerning the examination. The error of the instrument is inappreciable in comparison with the chance variation of individuals.

The evidence for the above conclusions is as follows:—

The material for measuring the differences in difficulty of the various forms consists chiefly of four sorts: (a) records of over 800 individuals taking two or three forms in succession without any fore-exercise; (b) records of over 500 individuals taking two or three forms in succession after fore-exercise; (c) records of about forty individuals each of whom did all fifteen of the forms, in the order A, B, C, D . . . . O.

First let us get certain very reliable differences estimated. Forms A and J being taken in that order, the median difference is J-A = 12 ± 0.7 for 154 college students. Forms A and F being taken in that order, the median difference is F-A = 10 0.7 for 160 college students. So J-F = 2 ± 1.0. Forms F and K being given in that order, the median difference is K-F = 2½ ± 0.3 for 351 college students. Forms J and K being given in that order, the median difference is K-J = 3 ± 0.5 for 144 college students. So J + 3 = F + 2½ or J-F = — 0.5 ± .06. Combining all the results J-F = .75 ± .75, or approximately J = F + 1. Forms B and F, and A and J, being given in those orders, the median difference F-B = 15 for 200 college students; the median difference F-A = 10 for 160 college students. Hence, we have B + 15 = A + 9 or B = A-6. Forms A and G being given in that order to 113 college students, we find the median difference to be G-A = 9. Since F-A = 10, J-A = 12, G = J-3 or G = F-1; but since, in the long run, F = J-1, we may put

$2G = J\text{-}3 + J\text{-}2$ or $2G = F + 1\text{-}3 + F\text{-}1$, whereby $G = J - 2\frac{1}{2}$ or $G = F - 1\frac{1}{2}$.

The forms Practice form, B, and C being given in that order, we have a median difference $C - B = 12$ for 86 individuals. The forms Practice form, B, and F being given in that order, we have a median difference $F - B = 10$ for 126 individuals. Hence $C - F = 2$ or $F = C - 2$.

So far we have $J = F + 1 = G + 2\frac{1}{2} = C - 1$, and $B = A - 6$.

Assuming that the general practice gain from second trial to third trial is 3,[1] we can evaluate H and K as follows:—

In X G H, the median $H - G = 9$ for 113 individuals. $H - G$ irrespective of position would then be 6, and $H = G + 6$. Since $J = G + 2\frac{1}{2}$, $J = H - 6 + 2\frac{1}{2}$. So $H = J + 3\frac{1}{2}$. In X F K, the median $K - F$ for 151 individuals is $1\frac{1}{2}$. $K - F$ irrespective of position would then be $-1\frac{1}{2}$, and $K = F - 1\frac{1}{2}$ In X J K the median $K - J$ for 144 individuals is $3\frac{1}{2}$. $K - J$ irrespective of position would then be $\frac{1}{2}$ and $K = J + \frac{1}{2}$. Combining the two lines of evidence on K, $2K = F + J - 1$, whereby $2K = F + F + 1 - 1$, and $K = F$, or $2K = J - 1 + J - 1$, and $K = KJ - 1$.

Assuming 12 as the practice effect of second over first position when no fore-exercise is given, we can evaluate A. We have (from the sequences A F, A G and A J,) median differences for 160, 113 and 156 individuals, as follows:
$F - A = 10$, $G - A = 9$, $J - A = 12$, including the practice effect. Excluding it, we have: $F - A = -2$, $G - A = -3$, $J - A = 0$. From these $3A = 3J + 1\frac{1}{2}$.

So far we have $J = F + 1 = G + 2\frac{1}{2} = C - 1 = H - 3\frac{1}{2} = K + 1 = A - \frac{1}{2} = B + 5\frac{1}{2}$.

Using these facts we may estimate the amount of practice effect to be allowed for in those who took all fifteen forms in the order A, B, C, . . . O. If there is no practice gain from F on, $J + K$ will equal $F + G + 2\frac{1}{2}$. In fact $J + K = F + G + 4\frac{1}{2}$ in the group of 38 individuals who took all forms. There seems thus to be a gain of about $\frac{1}{2}$ point per form due to practice at this stage. If there is no practice gain from C to F G, $F + G$ will equal $2C - 5\frac{1}{2}$. In fact $F + G = 2C + 10$. So the practice seems to be $+7\frac{1}{2}$ from G to F G, or about 2 units per form.

[1] 3 is the median of 13 such cases. Also, G and J being so taken by 26 individuals, the median $J - G$ was 5. Since $J = G + 2\frac{1}{2}$, the practice effect would be $2\frac{1}{2}$.

We may then assume that if all the forms were of approximately equal difficulty, the improvement from C to O would be approximately 2 2 2 1 ½ ½ ¼ ¼ ¼ ⅛ ⅛ ⅛. The average scores for C, D, E, etc. for the 239 individuals tested were, in order, 90, 97, 93, 97, 92½, 96½, 99, 99, 95, 97½, 97, 99, 97.

The amount by which each form is easier or harder than the average of all the forms may then be estimated approximately as:

C = Av + 1, D = Av + 6, E = Av, F = Av + 3,
G = Av − 2½, L = Av + ½, I = Av + 2, J = Av + 1½,
K = Av − 3, L = Av − ½, M = Av − 2, N = Av, and
O = Av − 2.

Using these facts to extend and amend the values already obtained, we have, in relation to the average:—

A = + ½ B = − 5½, C = + 1, D = + 6, E = O,
F = − 1, G = − 2½, H = + 3, I = + 2, J = O,
K = − 1, L = − ½, M = − 2, B = O, O = − 2.

We may now check these estimates by estimates derived from entirely different data.

Assuming that the practice effect of second over first position when fore-exercise precedes both[2] is 7, we have G − B = 12 − practice and C − B = 10 − practice from 126 and 86 individuals respectively. Hence B = F − 3 and C = B + 5. Since F is accurately determined as Av − 1, we have B = Av − 4 and C = Av + 1.

313 individuals having Practice form, D, and E, showed a median E − D = 4½. Apart from practice, then, E − D = − 2½. 28 individuals having Practice form, G, and H, showed a median H − G = 9. Apart from practice, then, H = G + 2. 20 individuals taking O and E after fore-exercise, showed a median difference of E − O = 10. Allowing for practice E − O = 3. O = E − 3.

15 individuals did G, H, and I, five in the order G, H, I, five in the order H, I, G, and five in the order I, G, H. The median scores were 108, 115, and 110, whence H = G + 7, I = G + 2, H = I + 5.

27 individuals did forms F and G in that order without fore-exercise. The median G − F was 10. Allowing 12 for practice, G is 2 harder than F, or G = F − 2. 7 individuals did forms D and J in that order, without fore-exercise. The median J − D was 7. Allowing 12 for practice, J is 5 harder

[2] This assumption is made on the basis of the fact that, including the effect of practice, C − B = 12 for n = 86, F − B = 10 for n = 126, E − D = 4½ for n = 313, H − G = 9 for n = 28.

than D, or D = J + 5. 36 individuals did forms F and J in that order without fore-exercise. The median J — F was 13½. Allowing 12 for practice, J = F + 1½. 33 individuals did forms G and J in that order without fore-exercise. The median H — G was 15. Allowing 12 for practice, J = G + 3. 26 individuals did forms G and J in that order as second and third. The median difference was J — G = 5. Allowing 3 for practice, J — G = 2, or J = G + 2.

28 individuals did forms J and L in that order without fore-exercise. The median L — J was 11. Allowing 12 for practice L = J — 1. 15 individuals did forms G and K in that order as second and third. The median difference was K — G = 4. Allowing 3 for practice, K — G = 1 or K = G + 1. 36 individuals did H L in that order as second and third. The median difference was L — H = — 1. Allowing 3 for practice, L — H = — 4 or L = H — 4.

Similar data for the sequences K M, J M and L M give the following:

n = 9, median difference M-K = O. So M — K = — 3; M = K — 3.

n = 40, median difference M-J = 2½. So M-J = — ½; M = J — ½.

n = 28, median difference M-L = 4½. So M-L = — 1½; M = L + 1½.

Similar data for the sequences C N, K N, and L N give the following:

n = 9, median difference = O. N — C = — 3.

n = 7, median difference = 6. N — K = 3.

N = 4, median difference = 1. N — L = — 2.

Using these facts we have the following estimates to compare with those previously obtained.

		Previous Estimate.	Estimate from Accessory Data.
A	Av	+ ½	
B	"	—5½	—4
C	"	+1	+1
D	"	+6	+4
E	"	0	
F	"	—1	
G	"	—2½	—2½
H	"	+3	+2
I	"	+2	— ½
J	"	0	+ ½
K	"	—1	
L	"	— ½	—1
M	"	—2	—1
N	"	0	—1
O	"	—2	—3

On the whole we shall not be in serious error if we take A = E = J = L = N, counting C and I as 1 point easier, F, K and M as one point harder, H as 3 points easier, D as 5 points easier, G and O as 2½ points harder, and B as 5 points harder. The probable error of these estimates ranges from about ¼ to 1½ points.

CORRELATION OF ARMY ALPHA INTELLIGENCE TEST WITH ACADEMIC GRADES IN HIGH SCHOOLS AND MILITARY ACADEMIES

By H. E. Burtt and G. F. Arps, Ohio State University

Introduction

Numerous studies have been made in recent years comparing mental tests, and especially intelligence tests with academic grades. The underlying hope seems to be that a student with good mental ability or intelligence (original nature) will do well in school or college and receive good marks and that, hence, it will be possible to predict future academic status on the basis of tests which measure intelligence. One of the most notable results of practically all such studies is the low correlation obtained. A correlation of .50 seems to be the exception rather than the rule, and prediction based on a correlation much smaller than this is of doubtful value in the individual case.

There are at least two errors which might contribute to these low correlations: either the tests are not an accurate measure of mental ability or the school marks are not an accurate measure of academic ability. Either measure is of course vitiated if the work is not performed with maximum incentive. It is probable that most pupils work with a fair approach to their maximum ability in taking mental tests. The test is usually brief and does not reach the point of producing "annoyingness" as is often done by school work. Furthermore the pupil being unaware of the real purpose of the tests assumes that a good deal is at stake and, consequently, does his best. It is probable on the other hand that many students do *not* work with maximum incentive in their studies or do not devote to them sufficient time to manifest their maximum ability. Any teacher would heartily endorse this statement. The writers feel that this latter alternative is a possible explanation of the low correlations generally found between intelligence tests and academic status. Suggestions of this sort have been made before.[1] It would seem further that certain types of instruction hold students more closely than

[1] Anderson, J. E., Intelligence Tests of Yale Freshmen, *School and Society*, Vol. XI, 417-420.

other types to their maximum intellectual ability. One of the writers found a noticeably closer relation between the adult "point scale" (Yerkes) and grades of students in a psychology course which had frequent and vigorous written examinations than between point scale and total academic marks for a similar group.[2]

During the summer of 1918 one of the writers was in charge of the mental examination of a group of R. O. T. C. men at Camp Custer, Michigan. Most of the members of the group were at the time in the midst of their course in high schools or military academies. These two types of institution differ considerably in methods of instruction especially with respect to supervision of study, general supervision of pupils and systems of demerit (punishment). It seemed possible by comparing the intelligence tests and academic marks for those groups to determine whether the methods of instruction do differ in the extent to which they elicit maximum intellectual performance in school.

Method

Academic marks prior to army service were obtained from the heads of schools and academies which these R. O. T. C. men had previously attended. The information was obtained on a blank calling for the average mark of a student in science, mathematics, languages (including English), history and "other subjects" and also the number of courses of each sort that were taken. Most of the marks obtained were in numerical form so that statistical treatment was possible. It was an easy matter to obtain a single average for total academic work by weighting each branch of study in proportion to the number of courses taken in that branch.

It is obvious that marks obtained from different schools with their different standards of marking could not be validly grouped together in crude form to obtain a correlation coefficient. Even if the marks were thrown in to terms of average or passing mark there would still be a source of error in the scatter for different schools. Consequently, each school or academy was taken separately and the mean and standard deviation obtained for total academic marks of the R. O. T. C. men of that school and the mean and standard deviation found also for the various school branches for those same men. Each individual mark was then put in the form of X

[2] Yerkes, R. M. and Burtt, H. E. The Relation of Point Scale Measurements of Intelligence to Educational Performance in College Students. *School and Society*, Vol. V, 535-540.

divided by standard deviation where X is deviation from the mean. Thus a student with a score of + 1.5 in school A is of the same academic ability as a student with a score of + 1.5 in school B, although the passing mark and the scatter of the students in the two schools are entirely different. The score simply indicates what proportion of the standard deviation for this school the person is above or below the average for this school. Scores of this sort were then available for all the features of interest, and it was valid to include all the military students in one group and the high school students in another. No school was included from which there were fewer than ten R. O. T. C. men. These scores were then plotted against the Army Alpha Intelligence Test and the correlation computed by the products—moments method.

Results

The correlations are based on 118 men in five military academies and 93 men in eight high schools. The groups themselves are very similar in intelligence as shown by the test. The military academy group has a mean score of 129 and a standard deviation of 25.6, while the high school group has a mean score of 130 and a standard deviation of 25.8. The principal interest lies in the comparative correlations for the two groups. These are given in the tables.

TABLE I

Correlation Alpha Total With:	Military Academies	High Schools
Academic total	.39	.19
Mathematics	.32	.16
Science	.47	.18
Language	.42	.22
History	.40	.25
P. E. (Approximate)	.05	.07

TABLE II

Correlation Academic Total With:	Military Academies	High Schools
Test 1	.41	.06
Test 2	.36	.14
Test 3	.19	.27
Test 4	.41	.27
Test 5	.32	.26
Test 6	.25	.16
Test 7	.45	.18
Test 8	.25	.37
P. E. (Approximate)	.06	.08

Table 1 gives the correlation of the total Alpha score, that is the general intelligence rating, with the total academic marks and also with marks in several school branches. The correlations are of about the same order that is usually found in similar studies. The most noticeable thing in the table is the correlation of intelligence and total academic ability of .39 for the military group as contrasted with .19 for the high school group. This is a most significant result of the study. The writers feel that it indicates a superiority of methods of instruction in military academies from the stand point of holding the students to their maximum mental efficiency. This result does not seem to be due primarily to any single school subject. The difference between the correlation for the two groups holds rather consistently with various school subjects as indicated in the other figures of the table. The difference seems to be slightly greater with science and slightly less with history but it is very doubtful if this fact is of significance. It is impossible that the discrepancy between the two groups could be due to a greater homogeneity of the high school group in intelligence because the standard deviations show that the distribution curves of the two groups are practically identical.

Table 2 gives the correlation of total academic marks with the eight different tests of the Alpha Examination. This table is not as significant as the first. There are two tests, 3 (practical judgment) and 8 (information) in which the correlations are slightly higher for the high school group but the differences are not significant when the P.E. is considered. The greatest discrepancies in the other direction are in test I (directions) and test 7 (analogies). This would suggest that these latter tests are somewhat more indicative of the instruction differential between the two types of school.

It seemed worth while to investigate the linearity of the regression in the case of the two principal correlations of the study. The correlation ratio (eta) was found to be .52 for academic total on Alpha total in the military group and .49 in the high school. The corresponding correlation coefficients were .39 and .19. Blakeman[3] suggests several formulae which give the ratio of the difference between eta and r, or of the difference between their squares to the probable error. His simpler formula (recommended for rough work) gives a value of 2.8 for the military regression and 3.2 for the high

[3] Blakeman, J. On Tests for Linearity of Regression in Frequency Distributions. *Biometrika*, Vol. 4, 332-350.

school. His more exhaustive formulae, (one giving ratio of difference of squares to probable error and the other giving ratio of difference of first powers to probable error) agree closely in yielding values of 3.0 and 3.9 for the respective groups. Blakeman considers that this value should be less than 2.5 (corresponding to a probability of 9 to 1) to indicate linearity.

These figures indicate that for the high school regression at least the observed values fit some curve more closely than they fit a straight line. Inspection of the scatter plot suggests a considerable concentration in the quadrant for high intelligence and low academic grades and the possibility of the regression line curving somewhat in to that quadrant. Many of the individuals in this quadrant are doubtless those who have good ability but are not induced to use it in school. This feature is not nearly as clear in an inspection of the plot for military students and furthermore Blakeman's test shows this regression to be more nearly linear. These facts are a further corroboration of the main thesis of this study.

Conclusion

The low correlation generally found between intelligence tests and academic marks may be to a considerable extent due to the fact that methods of school instruction do not hold students to their maximum efficiency. The correlation of Army Alpha with academic marks in high schools and military academies yields an appreciably higher correlation for the latter group. This is not caused by differences in homogenity of the groups nor does not seem due primarily to any special school subject but to be a general characteristic throughout the curriculum. This suggests that methods of instruction in the military academy, such as general supervision, supervised study and a system of reward and punishment, are more apt to hold the student to his maximum intellectual ability.

SHOULD PSYCHOLOGY BAKE BREAD*

ELIOTT FROST, Rochester, N. Y.

I

Baking bread is a human task, popular rather generally, and over a sufficient number of years to give it standing among the very best people. Perhaps for these several reasons we allow it in our thinking to typify the practical. Should psychology in this sense bake bread, and if so what kind of bread should it bake?

It is to be generally admitted that a science implies the observation and collection of raw facts, and the correlation of these facts under laws. Such laws once determined may, if we so desire, then be utilized to secure ends—either theoretical purposes which shall lead us on to additional facts; or practical ones which shall help us to justify our studies by enabling us to aid in the solution of those very human problems that we all, from time immemorial, have faced.

There is no one of scientific temper, who would care to defend the thesis that truth is "its own excuse for being" if by the statement we mean that the question—"What is this true thing *good for*," is a wholly irrelevant one. Whatever our personal inclination may be as to the propriety of our making applications of our data once they are assembled; whatever our belief as to the timeliness of attempting application of a particular science, or of attempting it under any special conditions, there is a very general admission that both the excuse and the incentive for research, lies in the fact that the results of it may, in due and proper time and under some auspices, receive justification through use. Such employment of our results may be, and may properly be, indefinitely postponed or even left for future generations to harvest in benefits, but in our minds there must always be implicit expectation that somebody sometime will somehow translate into terms of life those formulae which we here and now devise and amplify. Otherwise we are lending ourselves, our energy, and our training to an avocational pursuit which perhaps may be permitted as temporary recreation but for which we have no

* Read before the local branch of the Academy of Science, Rochester, N. Y., March 1920.

right to receive the support and rewards of society. Thus to employ our entire time is to be as truly a parasite upon the social host as if our days were successively spent on the golf-course or at the chess-board.

One of our psychologists is alleged to have said—" I should be just as much interested, were I a geographer, in plotting some insignificant South Sea Island of no consequence to anyone, as I would in plotting the Island of Manhattan." Such a statement, if true, needs interpretation. If by that he means that he, personally, would not be interested in accomplishing practical results, and seeks only for truth (which someone else of different temperament might subsequently apply)—that is one thing. On the other-hand, if he means that he would willingly devote his time to the investigation of a pursuit which would have and could have no advantage for anyone—that is an entirely different affair. Truth for its own sake is an excellent slogan as far as it goes but it never can or should tell the whole story.

Let us therefore analyze our original question with care, distinguishing it from the entirely different question—" Should *Science* Bake Bread? " In the latter question we leave out of account the age of our particular science and its particular development. In short, it may well be that we subscribe fully to the general applicability of science and still deny categorically that psychology is ready for such application.

II

At least two considerations may militate against the wise application of a science: First, the science may be so new and its conclusions in consequence so half-baked, that the premature utilization of them are of no value; or second, we run a liability of prejudicing the future of the science itself, not only in the minds of practical men but in the minds of our own investigators, so that their subsequent researches are partly, even though sub-consciously controlled, now no longer by a search for truth but by such biases and opinions as would be dictated by needs. This latter result, should it occur, would be not only unfortunate, but calamitous, for it would poison our springs at their source.

We are now, if this be granted, in a position to clarify and simplify our topic although we state it at greater length: " Is psychology, as such, already sufficiently developed so that it may hope, at least in part and wisely, to offer its formulae and conclusions as practical recipes toward the solution of human problems? "

It might seem, in the light of what has transpired, particularly during the last four years, that the question is being asked a decade too late, were it not for the fact that a considerable number of eminent American psychologists have persistently given a negative and *a priori* answer to the question; while many others, if of lesser note, after viewing the attempt of psychology to sell its services generally have been won over to a similar, though *a posteriori*, conclusion. Some in short have said " No, psychology should not attempt to apply itself " while others have added—" Such attempts as it has made have not justified themselves."

To those of you who have followed psychological discussions and psychological literature for the last fifteen years, from the time when Münsterberg railed against the application of psychology; through the period when he wrote his numerous books suggesting just such application; down to the present time when our psychological meetings have veritably centered about applied interests, it will seem that most psychologists have answered our query in the affirmative. Psychological applications to education, to medicine, to advertising, to personnel, and to industry have of late been presented to us in a bewildering swarm.

What is the net result first upon the object sought, and second upon the science which has offered its service? As to the first of these questions, namely, whether or not the results obtained have been satisfactory, it is the opinion of the writer that they have not, if we measure those results in terms of energy expended. Probably the application of psychology to medicine even in its indirect consequences comes nearer to offering results of which we may be proud than does any other field. Even here however we have had to contend with psychoanalytic orgies, psychotherapeutic buncombe and a congeries of lesser quackeries which have so enveloped the kernel of truth contained, as to handicap and postpone the success that might have come from a more conservative investigation of the premises upon which our somewhat hasty conclusions have been based.

On the other-hand, what we have failed to gain in therapeutic diagnoses and prognoses; in pedagogic recipes or industrial formulae, is made up for—and probably more than made up for—in other ways. We have brought the terms and the processes of psychology before a very wide and very important public. Since a few years ago when Mr. Wilson declared the trouble of business to be " psychological," men have ceased

to look sheepish when they use the term. To-day we find the literature of industry naturally adopting psychology as a necessary, explanatory science.

Psychology suffers and always must suffer from a matter-of-fact point of view, by the circumstance that she is dealing with processes rather than masses and molecules. This aggravates the difficulty of our descriptions and explanations but in no way lessens the importance of them. On the contrary, the duty of spreading knowledge concerning human instincts, feelings, emotions, and reactions, was never so universally recognized as to-day. The fields are plowed and fallowed as never before for every constructive suggestion that psychology has to offer. For this happy result the embryonic essays of the last decade in psychology are chiefly responsible, however insignificant the specific success of any particular planting.

Those who are familiar with the work of Veblen's disciples: Helen Marot's "The Creative Impulse in Industry" and Ordway Tead's "Instincts in Industry;" those who have read the life of Carleton H. Parker or who know the work done by Mr. Robert M. Wolfe in his pulp and paper factories, those who have followed the development of Industrial Relations men, the Labor Manager, and the Employment Manager; those who have been studying the newer ideas of plant management, plant sanitation, bonus and profit sharing systems, and the training of foremen; those who have followed the course of labor adjustments in England through the Whitley reports and elsewhere; and those who are familiar with the innumerable boards, bureaus, commissions, and societies designed to ameliorate industrialism, and put back the loyalty that comes from content and creative opportunity—to all such one need not emphasize that the principles of psychology are being put to work in industry to-day, and as a direct result, undoubtedly, of what psychology has done in other fields already now for many years.

Quantitative changes in time always involve qualitative changes. In theory the ocean is but the aggregation of drops of brine. This ocean however knows of things of which the droplet never dreamed—winds and storms and waves, icebergs and shimmering sea, depths and foam, climate and colors and temperatures—all these things and many more. Just so has our industrial life grown from the small shop with the single employer and his handful of friendly assistants to a huge depersonalized corporation controlled by absentee capital and engulfing the human individual unit as one drop by the sea.

Ancient contacts are rendered impossible; specialization has demanded mechanization, the human has become the machine. Mass psychology has supplanted the zests and rewards of individual initiative. Our industrial patient has become ill and we are collectively concerned to discover some remedy for that which we could not apparently foresee or prevent. The human factor will no longer be denied. The drop refuses longer to be merely a part of its environment.

Either we must break up our great industries and return as some firms are doing, to a group of relatively small plants, distributed in relatively small communities (while maintaining perhaps a centralized control), return that is, to conditions where the individual worker may still maintain himself as an individual, and enjoy his home, his family and avocations; or, where the plant is necessarily large we must pyramid friendship so to speak, provide, that is, for open channels and organized contacts between management in the office and loyalty in the shop. The one thing we can no longer do is to ignore the vital human relationships which separate the independent spirit from the spirit of the slave.

III

We come then to the second portion of our problem. What is the effect of success upon the science itself and those who carry its torch?

One must confess the answer to this question is difficult,—not that there is so little to say but so much. If one felt that the achievements or even the program of theoretical psychology ten or fifteen years ago, (prior to the recent expansions into the domain of applied psychology) were dealing with important and illuminating issues then he would incline to the view that we were fallen into unprofitable times. On the contrary, if you will take pains to review the topics presented for consideration and discussion at the annual psychological meetings, say fifteen years ago, you will be impressed in the light of, and perhaps because of, subsequent and larger vision, with the sterility of most of the investigations undertaken. The incentives which have come to our science along practical lines, have not served as a healthful stimulus to more adequate research even for purely scientific interests. Just as the science of medicine has gone hand in hand with the practice of it, so it is possible and perhaps likely that within limits, psychology henceforth may fare. The danger is however always and near at hand that either because of public

clamor or financial reward we shall turn too quickly from our laboratory into the more remunerative fields. The ideal is, that there should always be a number of earnest men fitted by temperament and training to carry on pure research. If this group is guaranteed, we can without trepidation permit another group to test out in the realm of practical affairs such tentative conclusions as our laboratory offers. If these two groups are recognized as distinct and so maintained, we should expect progress, both for our sciences and in the solution of their practical problems.

IV

Admitting, then, that bread should be baked and that the psychologist, under certain limitations may properly be a baker, brings us to the very concrete problem as to what kind of bread. The answer is, to be sure, somewhat speculative and more than commonly so just at present. The industrial bakeshop is stirred mightily and there is much rattling of pans and kettles. New cooks with favorite recipes run about. Has the psychologist a place among them?

Three distinctly wholesale tendencies, which are working toward industrial stability, are *first*, the increasing willingness of competitive employers to meet and share their problems and solutions; *second*, the fuller recognition of the shop foreman in the industrial plant to-day as a possible salesman of the management; and *third*, the growth of departments of Industrial Relations.

First, then, the increased willingness of competitive employers to meet and share their problems and solutions. The intensely competitive era is passing. Unprecedented problems on the one hand, and on the other, the co-operations of the war to make the Liberty motor, to fabricate ships, and to place invention or patent at the Government's disposal, has hastened a tendency already apparent at the beginning of the war toward combinations and co-operations not only of captial but of idea. A single illustration of such development is the Industrial Management Council of Rochester, N. Y. now entering upon its fourth year of service, among forty odd of the leading manufacturers of that city. This Council is subdivided into seven groups: General Managers, Office Managers, Production Methods, Employment and Service, Superintendents, Cost Accountants, and Taxation. Its primary purpose is to swap methods and experience, and to gain additional information through surveys, investigation, and reports,

as to the best manufacturing practices from concerns inside and outside of the city.

The Council is operated by a Director and an Executive Committee, in addition to a chairman and program committee of each group. During the year, with the exception of the summer, the groups meet bi-weekly, and are addressed by experts whose talks then form the basis of questions and discussion. So far as is known, this program is unique and not duplicated in any other city of the country, though many cities have indicated their intention of forming similar organizations.

Out of the multitude of alleged panacea offered to the harrassed manufacturer to-day, one note is permanent and dominant: The necessity for more genuine mutual understanding and a more practical co-operation. This need and this principle hold true, not only as between the management and the worker, but among manufacturers and executives in the interest both of themselves and the worker. In the past, there has been the problem of the closed shop—the shop, that is, closed to the rival manufacturer and often in consequence closed to new ideas.

Manufacturers are now increasingly coming to feel that the welfare of any industry vitally depends upon the welfare of all industries, and that through the interchange of ideas, more will be gained in the long run. This would be offset through the temporary loss of advantage from passing along a good idea to one's neighbor. Upon this conviction the Industrial Management Council is built, and in conformity with this thesis, it operates.

All member concerns of the Industrial Management Council are represented in the Rochester Chamber of Commerce which houses the central offices of the Council and provides a meeting place for its members. Group meetings occur on a regular schedule throughout the year, are planned in advance, and are usually preceded by an informal dinner. The Chamber furnishes rent, heat and light; other expenses of the Council are defrayed by assessment upon each firm and according to a definite formula. Occasional group meetings of foremen, upwards of 1,000 at a time, are held under the auspices of one or more of the groups, and either foremen or workmen at the bench are always welcome as guests of members, since it is the interest of the Council to safeguard and promote the success and welfare of the worker no less than that of the management. Some synthesis must be found as between the

thesis of capital and the antithesis of labor. Their goal is, ultimately, the same, and we can no longer afford to postpone its realization by quarreling over methods. The Industrial Management Council is a sober and honest attempt to sit at a common council table, to view industry as a whole, and thereby to come to some conclusion which shall benefit all partners to it.

A *second* hopeful sign of our industrial times is the fuller recognition of the shop foremen in the industrial plant to-day—the recognition of the need not only for choosing the right kind of man but for giving him the right kind of education once he is found. It is coming to be increasingly true that the foreman marks the measure of success attained by the industry, and makes more than a nominal contribution to it. He is in a position to sell the ideas of the management to the employee and to sell the employee to the management. He is the lock in a canal. If he fails to work, there is danger that the waters on either side of him may grow stagnant and breed discontent.

Nor are factors lacking to produce just such a situation. In the first place the foreman has a bad history to overcome. He has been treated in times past as a cog in a machine, whose primary duty was to get out production at any cost. Physical prowess, a bull-dozing manner, the inspiring of fear;—these formerly were considered assets and men were picked as foremen because of their possession of them. The modern tendency in industry to adopt methods of suasion rather than compulsion has left us with this body of men trained to the exercises of authorities which we now deny them. If our newer ideals are to persist, we must either select new foremen or re-educate such as we have.

Against the effectiveness of this key-man in industry, militates also the vivid radicalism of a relatively small group of agitators. These men speak with a sincerity, or an apparent sincerity, worthy of a better cause. If we could but grant the major premises, we must admire their minor premises and their conclusions. They use short Anglo-Saxon terms, they speak and write so that even the simple-minded can understand. There are said to be nearly 1,200 periodicals, regularly published, in this country, sufficiently red of hue as to come under the category of 'Bolshevik.' Such husky germs can be killed by one specific only: the truth. The foreman is the one man who can quickly, by word and deed, morning, noon and night, administer this remedy. But he must first possess

it. That is the responsibility of management: to give him the facts and keep him sold, lest, instead of becoming a doctor for industrial discontent, he himself catches the disease and spreads it.

Every foreman can become a salesman of the management. Few workmen know where the contents of their pay envelope comes from. Few know what 'overhead' means. Few, if any, have an idea of the cost of doing business or the risks involved. Yet the average worker is interested in economic education, although he may not know it by that name. Part of this interest has been aroused by this extraordinarily clever literature, mostly radical, which would be very important if true, but which is not true. If a man is told that his employer is making ten or even fifty dollars a day from his labor; if he is told that, day after day by word of mouth and printed paragraphs, and no one takes the trouble to tell him it is not so, he is likely in time to believe it. I would and you would. The large employer of labor cannot go into his factory and chat daily with all of his workers. He can however give his policies and his ideals to the chiefs under him, and see in turn that they are passed down the line to and through the foreman. Just as the Sergeant in the Army reflects his Colonel, so does the foreman in the shop reflect his chief in the office. If management does not take the pains to instruct its foremen, let it not expect that these men will keep the channels open, to and fro, between office and bench.

There are many present-day attempts to educate the foreman by courses of intensive study and lectures, notable among them the work of the corporation schools of New York, the National City Bureau, and the National Speakers Bureau. Already however, these admirable educational programs have met with criticism. In some cases it has been felt that the foreman was being educated beyond his intelligence and into a restlessness toward, rather than a loyalty to, his job. It is claimed further that the teaching is valuable, as most teaching largely must be, only in the hands of excellent teachers, and such personnel is difficult to secure and repay. Finally the economic laws which govern our industrial life are operating also here and foreman training is likely to be advocated in direct proportion as the supply of foremen is limited. In other words when labor is plentiful the average manufacturer will simply select the best foremen and bother himself very little about the remainder.

A *third* index of a fortunate industrial evolution is the increasingly significant rôle played by the departments of Industrial Relations, and the correspondingly larger number of men with special training and ability who seek them. Leaders in this new enterprise are receiving large salaries, and, speaking generally, they earn them.

During the war, the Army and Navy each added a Morale Branch to its General Staff; too tardily, it is true, to achieve the effective success that an earlier recognition of the principles would have permitted, but sufficient to sell the idea to the permanent and regular establishment. Since the war, with a demand for production still abnormal, under-production has been a common lament, and is correlated with high labor turnover, strikes, and mental hysterias beyond precedent. William James long ago pointed out that none of us is maximumally efficient; that we possess latent sources of energy we seldom, if ever, tap. Added to these inefficiencies we now have those which come from a sullen and unwilling spirit, from a moral refractory period following the intensities of the war, and from the aggravating but separate circumstance that labor and capital have lost the personal touch.

Industrial relations are passing through a critical phase. Viewed by many manufacturers as a necessary sop, grudgingly granted, there is a tendency to take the short, rather than the long look, in a hopeless attempt to return to things as they were. On the other-hand, manufacturers with wider vision who are less interested in concerns of the moment and more interested in building for the future, contemplate this newer machinery which the times have set up, as an asset whose interest return will more than justify capital expense. If industrial safety, industrial housing, hiring and transfer of employees, training of workers, mental incentives and the sharing of responsibility, are looked upon as beneficences, the first easement of the labor market will sweep them into discard as economic irrelevancies. But the thoughtful manufacturer no longer so considers them. He is willing to buy and pay for loyalty no less than brains and muscle; he realizes that he must attract virtue no less than reward it.

Just how many manufacturers will fall into this category of the 'thoughtful' when times change, and the man seeks the job, rather than as at present, when the job seeks the man, it is difficult to predict. Until it can be established beyond peradventure that it pays to educate the man *into* his job and *in* his job, gratuitous education is not kindly taken to. One's

prediction depends in part upon his interpretation of human nature. Either for lack of vision, or for lack of money, or both, most industries will probably make shift to use the human material that they have on hand in much the same condition as they find it. For those of us who are interested in the dissemination of education, this is discouraging but we must take the world as it is. It does not help much to criticise life. We can modify its formulae but slowly. Because we cannot secure high-minded unselfishness on the part of all of our employers is no adequate ground for pessimism. Enlightened self-interest is quite a different affair from selfishness. If we can prove that the goal we set in our co-operative policies, our foremens' training, and our industrial relations, ministers to the good of the individual by ministering to the good of all, we shall have taken a step forward and up.

Since most industrial problems are at bottom due to ignorance, they can be satisfied only by educational programs of some sort. There are many signs of a closer liaison between our universities and our industries. Several of our colleges and technical schools, notably the University of Cincinnati, have formed a close alliance with their neighboring industries, alike to the benefit of the factory and of the school. Some of our industries too, such as the Goodyear Tire Company, the Ford Motor Company and others, have established universities within their own plants, and financed them with a generosity which compares not unfavorably with many of our smaller colleges.

V

Specifically, the technique of the psychological laboratory, is not yet sufficiently standardized to translate it effectively to industry. Such work as that of Link is a good step forward but it is necessarily limited in scope. The major premise that the human problems of industry are psychological is well established and curiously enough, industry and not psychology has been the first to recognize it. But the minor premise of application still is lacking and likely to remain so until we develop a larger group of men whose interests and background are both psychological and industrial. The man without psychological training will miss the forest for the trees; the man without industrial experience will see the forest but miss the trees. All of which is only to say that industry inclines to be over-practical, measuring results too objectively and quickly in profit and loss; while the laboratory psychologist leaves out of his reckoning a hundred and one variables

due to type of product, nationality of worker, history of management, and the factors of production control, which vary with each industry.

Industry to-day is needing the psychologist, certainly, or at least the man of psychological temper; but he must come to her with his overalls on; must supplement the truth he knows with facts gained by experience, and must be as eager to learn as to teach.

Underdone bread is sometimes worse than no bread, and makes for indigestion. If the psychologist is to do any industrial baking, he must learn first to cook, for as everyone knows, cooking is an art and its secrets lie outside of books.

A FURTHER DEVELOPMENT OF EMPLOYMENT PSYCHOLOGY

By HENRY C. LINK

Aside from the mere selective and classifying value of tests there are connected phases of employment procedure in which the psychological technique may be very valuable. The psychologist in industry finds in his technique, an instrument which sometimes gives him a great advantage over the ordinary employment man when it comes to analyzing labor supply, adjusting rates, discovering inconsistencies in existing employment procedure, etc., etc.

The following study, made in an industrial concern in which tests were a supplementary part of the employment procedure, indicates several directions in which the industrial psychologist may look for practical results.

During a period of six months, the psychological section of the personnel department had given clerical tests to 616 women who applied for clerical work. The method by which these tests were put into operation and the results followed up is described elsewhere. At the time when the study described here was made, the success of the tests had already been established.

Of the 616 applicants examined—

287 recommended by the psychological section had been hired;

137 had been recommended but not hired;

173 had not been recommended and not hired;

19 had not been recommended but hired nevertheless.

The employment office had therefore followed in the main the recommendations made by the psychological section. However, the large number of applicants recommended but not employed, taken in conjunction with a constant shortage of clerks, made the following study advisable. The purposes of this study were:

1. To open up new sources of clerical workers.

2. To determine on the basis of tests which had already proved satisfactory, how the performance of the applicants examined in the employment office compared with the performance of potential candidates who had not yet applied for positions.

3. To determine a basis for adjusting earning rates so as to make possible the selection of the most promising potential applicants.

4. To point out discrepancies which were known to be present in the existing employment procedure.

A series of group tests, therefore, was given to (a) the senior class of the commercial high school, 181 pupils; (b) the beginners and advanced class of the X business college, 42 and 31 pupils respectively; (c) the advanced class of the Y business college, 38 pupils. The principals of these schools readily fell in with the plan of the study when its purpose was explained to them. The tests given were: (1) Woodworth Wells number group checking test; (2) a simple addition and subtraction test; (3) directions test; (4) letter substitution; (5) spelling; (6) alphabetical filing. These tests were given and graded by the same method as that used in the employment office, and by the same examiners.

The results of the study are shown in the following chart. For the sake of simplicity, actual averages are omitted and group ranks given instead.

		Group Tested	No. in Group	Rank in Tests	Rank in Educ.	Rank in Age	Average Age
Applicants tested Employment Office	1.	Recommended and hired....	287	7	7	7	21.
	2.	Recommended and not hired.	137	3	3	8	21.1
	3.	Not recommended—not hired	173	8	9	9	21.9
	4.	Not recommended but hired.	19	9	3	6	20.8
Pupils tested in school	5.	High school girls.....	143	1	1.5	3	17.9
	6.	High school boys	38	5	1.5	2	17.1
	7.	X Business College (A. C.)...	31	2	6	1	16.2
	8.	X. Business College (B. C.)..	42	4	5	4.5	18.5
	9.	Y Business College.....	38	6	4	4.5	18.5

Rank in education is based on the number of years completed in school. The high school seniors had almost twelve years of schooling to their credit and are therefore ranked highest in this respect. The group of applicants not recommended and not hired had only nine years of schooling to its credit and is ranked last.

The results of this study showed very clearly:

1. That the senior girls of the high school stood highest in their performance. On the basis of actual averages the performance of this group in the tests was 30% better than the

performance of Group 1, the group of applicants who were tested in the employment office, recommended, and hired.

2. The group tested in the Employment Office and recommended but *not hired* (Group 2 on the chart) is the only group among those tested in the employment office which compares favorably with the high school girls and girls of the X business college (advanced class.)

3. The pupils of the Y business college and of the beginners class of the X business college compare favorably with Group 1, the group of applicants recommended and hired.

4. Though the number of high school boys tested is comparatively small, their performance was considerably poorer than that of their girl classmates.

5. There is the usual correlation between performance in tests and education, but a much less marked correspondence between rank in tests and age.

Some of the above facts raised pertinent questions as to the existing employment methods.

In the first place, if the girls recommended by the psychological section of the employment office but not hired, represented the highest group of applicants, why were they not employed? The interview records showed that thirty-five of these applicants were either teachers or high schools pupils who wanted only summer work. Other reasons for not employing these applicants were: (1) They were already employed elsewhere; (2) the wages they demanded were above the starting rate for clerical work; (3) positions were not available at the time. With regard to the last two reasons, it was obvious that better rates and better selection might be in order.

In the second place, why were not more candidates secured from the high school and business college graduating classes? If these girls were much better in the tests than those hired, it woud have paid to offer them higher wages than the existing standard maximum. Besides superiority in the tests, this group had the benefit of 2.3 years more of education. Moreover, they were 2.9 years younger than the girls hired, a fact which would lessen the likelihood of their leaving on account of marriage. The hiring of a superior type of clerk would also make it possible to reduce the amount of equipment and supervision required. Fewer desks, less space, less supervision, and fewer mistakes, all incident upon the employing of a better type of clerk, would warrant an increase in the wages paid.

In the third place, why were nineteen girls who were not recommended by the psychological section, hired nevertheless?

Nineteen out of 616 is, to be sure, a small number. Of this number four had left or been discharged as unsatisfactory. Why was the number of those leaving so small? Partly because a majority of these girls had been brought in at the suggestion of department heads or friends. It is difficult to check up the work of clerks hired in this way, largely because they are working among friends. However, it frequently happens that an unsatisfactory applicant is hired because of a pressing emergency.

To sum up, the results of this study showed the importance of some knowledge of the available labor supply, and a basis upon which to determine its relative desirability. It showed that predetermined starting wages had eliminated some of the most desirable applicants. It showed that a system of flexible starting wages was highly desirable, *if* the wages could be varied in accordance with the quantity and quality of the available labor supply. These problems are among the most important and recurrent which the employment manager has to deal with.

PICTURE COMPLETION

ROBERT H. GAULT, Northwestern University

This paper reports an attempt at scoring picture completion records obtained from one hundred and eighteen delinquents and dependents in the Juvenile Psychopathic Institute in Chicago. The major portion of the work was done by Mrs. Ruth Sanders Thompson, Fellow in Northwestern University during the academic year 1918-1919, under the direction of the Department of Psychology.

To obtain the one hundred and eighteen cases, Mrs. Thompson read without omission, a block of nine hundred records that had been made prior to September 1918. These include all the records made at the Institute during a period of almost two years. From these were selected all those who had undergone test by the Binet and the Stanford Revision, the Seguin Form board, and Healy's Picture Completion, (older form) and whose intelligence quotient was sixty or over. There was no other selection. The chronological ages of the cases range from seven years and no months to fourteen years and eleven months. Only two of these are at age seven years to seven years and eleven months, and four at age eight years to eight years and eleven months. It happens that the remainder of the one hundred and eighteen cases are almost equally divided among the ages nine years to fourteen years and eleven months. The intelligence quotients of seventy-four of these one hundred eighteen Juveniles are almost uniformly distributed over the range of sixty-five to 79.9 inclusive. Sixteen lie between sixty and sixty-four and nine tenths; fourteen are between eighty and eighty-four and nine tenths; six between eighty-five and eighty-nine and nine tenths; five between ninety and ninety-four and nine tenths and the remaining three are between ninety-five and ninety-nine. The mode, therefore, lies between seventy and seventy-four and nine tenths; rather nearer the latter figure than the former.

The primary purpose in undertaking a study of these one hundred and eighteen was to retest them by such means as should be deemed suitable, and in the light of the data thus obtained and in the light, too, of their recent social history, to return to an examination of the original findings.

It is not my intention to enter into this aspect of the work

in this paper. The secondary purpose of Mrs. Thompson's investigation was to find the degree of correlation among the records of the children in the tests referred to above viz: The Binet Tests, The Stanford Revision, The Form Board and the Picture Completion Test. It is with this aspect of the work, particularly as it relates to the Picture Completion test, that I am concerned here.

Naturally we first of all met the problem of scoring performance in the Completion Test. In the records of the Institute we found only an account of the moves made by each child: that blocks were placed here and there. We had before us Dr. Healy's method of scoring by "logical" and "illogical" errors, and Pinter and Anderson's method based upon the total frequency of choice of each of the blocks that were selected by their 1,438 presumably normal subjects. There is a possibility of 369 moves in this test. Our one hundred and eighteen cases made 360 of them as opposed to 349 made by Pintner & Anderson's normal subjects. A few of our moves, therefore, have received no score in their scheme. Some of these were of such a nature that one could conceive of situations in which these moves could merit Pintner and Anderson's minimum score but not more than that. Accordingly we have assigned arbitrarily, a score of 0.1 to these cases and graded the one hundred and eighteen by the Pintner and Anderson scale. Correlation with the Intelligence Quotient gives a result of 0.32.

In reviewing the Pintner and Anderson scores I am impressed with the thought that in a great many instances associations to which a very low score had been given to their subjects because of their infrequency, may really appear to the juvenile to be a reasonable solution of a practical problem. The criterion of reasonability among these younger folk is *already realized experience*: it may be oft repeated or infrequent, but striking.

Possible experience is, on their part, never, or at best very infrequently, a criterion of reasonability. It should not even require pointing out that the reasonability, rationality, or logical character of behavior is determined by the way in which one uses the data of experience at one's hand. One may take all obtainable data into account and nicely balance one's course in the light of all the details conflicting or otherwise. (One may put the broken window in the window space.) In that case we should place a high rating upon the behavior or adjustment and we should describe it as logical with distinction. We must remember that the phrase "all obtainable

data" means one thing for me and quite a different thing for the youngster in the back streets.

One may overlook some of the details in the experience and suffer one's behavior or adjustment to the problem to be determined by the striking or unusual circumstance. In such cases, too, we should usually ascribe some degree of rationality and logical character to the behavior. If a youngster has seen a bottle of milk toppling from a high window but yesterday and narrowly missing a pedestrian below it would be a rational procedure, indeed I may say logical, for him to place the block bearing an illustration of a milk bottle in the window in the test and he should have liberal credit for making his own picture. If, on his way up and down the street one of the youngster's frequent visual experiences comes to him from the ubiquitous milk bottle enframed in each window in a row of tenements, once more it should be deemed rational and logical for him to place the bottle in the window space, and particularly so if he has, on rare occasions, taken a crack at it with his sling shot. That the connection-window space-milk bottle-occurred in but 0.3% of cases among Pintner and Anderson's subjects, and did not fall among the sixty-one most frequent cases, which they emphasize seems to me to be of less than great importance when one is attempting to build up a method of scoring that may be useful in estimating levels of intelligence.

I chanced to alight upon the milk bottle just now when I glanced around for illustrative material. The necktie-window, or the clock-window space connection or any one of a score of others, so varied is window furniture, embracing even socks, neckties and underdrawers, would have served my purpose quite as well.

Indeed I am sure that cases may occur in which the baby-fruit connection should be given a high grade for its logical character. Many a child and youth comes into our juvenile courts in large cities who knows nothing of picking fruit from a tree by the aid of a ladder and carefully placing it into a basket. Indeed we have not far to go to find youngsters even who do not know at all, or at best they know very vaguely, that fruit grows upon trees. Such a youngster may be dropping fruit upon the baby's head to tease him or may be bringing something pretty to comfort him. In either case, the reaction deserves a high grade for its logical and rational character. If you protest that any active and intelligent child will know and be able to appreciate the situation as you and I do, I can

reply only with the counter protest that your judgment is a-priori and, in addition, assert my belief that thousands of city children have *at best* but a *vague* book knowledge of fruit-on-trees such as can hardly be said to have any value, even as second-hand experience, for directing behavior.

Let me say furthermore, that the infrequent youngster of inventive disposition, provided he approaches the task of completing the picture in a playful mood, as he should, will make unusual associations. It may appeal to his sense of humor to make the boy run away, not from the dog, but from the crying baby, and very well for who whether adult or juvenile, likes to be in the vicinity of a crying baby? Yet this connection would doubtless appear so seldom that, in Pintner and Anderson's scheme, no credit would be obtainable for it, or at best but a small credit, whereas, in the light of all the inner and outer circumstances, we should willingly give the performer a high grade for having made his own picture.

Of course, you have leaped to the conclusion, and rightly, that I have now in the back of my head, a picture of a certain opposition between the so-called " objective " and the so-called " subjective " attitudes toward psychology and a suspicion that in this particular instance, at any rate, the so-called " objective " attitude does not touch the psychological problem. Having brought our psychology from one direction to the study of the individual, we ought not immediately to depart from the individual in another direction. We do so, if at all, at the peril of sacrificing the significance of psychology in its relation to human behavior. If we pin ourselves to the mere frequency of a form of behavior and make that a criterion of high standing in a test we are bound to lose sight, in the shuffle, of that individuality that is so highly prized in the world because it makes things go.

And so, as I said above, we came to the need for a method of scoring our one hundred and eighteen performances in the picture completion test. Dr. Healy's " logical " and " illogical " or " rational " and " irrational " criteria gave us our starting point, and we were immediately before the question, " what is logical? " and " what is rational? "

We arbitrarily assigned a value of one hundred to the broken window in the window space and the same to each of the following associations: running boy-dog; wood cutter-log; fruit-basket; milk-sleeping cat; playing boys-football; flying bird-tree; girl-hat; and chicken-chicken. The remainder of the sixty-one situations were then turned over to each one of a

group of eight including instructors and advanced students in the department of Psychology in Northwestern University, with the request that each one assign a value to each position. Each member of the group understood that he must needs keep in mind the possible motives of children such as come into the Juvenile Psychopathic Institute in a city like Chicago; this means that each one should keep before him the possible backgrounds of individual experience among such youngsters. We then brought our ratings to the table. In many instances the values assigned to a given position varied so little among members of the group that we considered it safe to strike a simple average to obtain what we would accept as a final value. In other instances where a considerable divergence obtained we discussed the case thoroughly at the conference table. There we sought for all possible light upon the ways in which a youngster, genius or of common mold, could interpret the situation in question. Finally we came to practical agreement upon the question of value in every case and the simple average gave us the accepted final weight. This done, it was a simple matter to apply our scale to the records of the one hundred and eighteen cases and to find the correlation of the standings so obtained with the intelligence quotients.

The correlation-Pearson coefficient-between the grades of the one hundred and eighteen in the picture completion and the I. Q. was 0.41. The result is considerably lower in relation to the Binet 1911 series.

We do not claim particular value for these results themselves. It is probable that we assigned too great weight to particular situations. Nor do we attach great importance to our method of obtaining a scale in as far as that method consists in sitting round a table in a suburban town seeking agreement of opinion as to what may have been the motives of back-street children in Chicago a year earlier or more when they placed a pot of flowers or a milk bottle in the window space in the picture. It does represent, however, an honest effort to take advantage of the psychologic background of the exceptional child.

I believe finally that the criteria employed by Dr. Healy are capable of development along the lines suggested in our crude experiment, and I have only this to propose that investigators, in their use of picture completion tests make every effort, by conversation with each individual under test to discover his motive for his several choices. When this has been done to the fullest extent possible, and when these motives have been

studied in relation to the social history of each case, it will be possible ultimately to assign a weight to each choice or move varying with the types of experience represented. A given youth may receive a high grade for a certain performance and another a lower grade for the same reaction. What seems, to the adult placed as we are here, an illogical reaction may in the light of our research be logical.

I am aware that this suggestion points to a heavy tedious task but I am convinced that it offers one method of giving proper weight to experience in our psychological tests.

A COMPARATIVE STUDY OF THE INTELLIGENCE OF SEVENTY-FIVE WHITE AND FIFTY-FIVE COLORED COLLEGE STUDENTS BY THE STANFORD REVISION OF THE BINET-SIMON SCALE

By S. M. Derrick, M. A., University of South Carolina

The study of the comparative intelligence of the negro and white races has engaged the attention of students only in recent years. The first investigation of this kind was made at the University of South Carolina in 1913 by Miss Strong (14). Since then similar studies have been made which have in the main corroborated the results secured by her. The investigations made by Sunne (13), Pressey (9), Phillips (8), Perring (6), Pyle (10), Odom (5) and others show that age for age the negro student is younger mentally than the white.

These studies were made with the grammar grade pupils exclusively. The present study undertakes to extend the investigation to the college students of both races.[1] It shall be the purpose of this paper (1) to make a comparison of the ages of the two groups of college students, (2) to make a comparison of the intelligence, (3) to determine the correlation of mental ability with school success, (4) to determine the correlation of mental ability with environment, and (5) to determine the difference in the specific mental traits of the two races.

This study was made at the University of South Carolina. The seventy-five white college students tested were students of the University, the majority being members of the Freshman and Sophomore classes. They were unselected students with whom the examiner was not acquainted previous to the testing. In the main, the students were tested in their own rooms. This was found to be the most convenient place and was favorable to the correct attitude on the part of the subjects. Care was taken to exclude all other persons from the room and distractions were kept to a minimum. The testing

[1] The work of Strong has been of valuable assistance in this connection, as have been the works of the other students of the races, referred to above. Many valuable suggestions have been received from Terman (16) as to the technique of administering the test. The writer is also deeply grateful to Dr. Josiah Morse for his sympathetic interest and helpful criticisms in the making of this study.

was done quietly and only when a subject could be found who had the time to give freely. Usually from forty-five to sixty minutes were consumed, depending of course upon the reaction of the individual. The tests were entered upon with interest, if not with zest. All seemed at ease and enjoyed the time spent.

The fifty-five colored students were secured at two colored institutions in Columbia; namely, Benedict College and Allen University. Subjects were secured from every class in college. However, due to the scarcity of college students it was found necessary to take a few men from the two upper classes of the high school. But these were all above the age of 16. Everything was done to make the work both pleasant and profitable. Favorable circumstances existed and the writer did not have any difficulty in getting the subjects to feel at ease. Marked interest was shown and enthusiastic endeavor was manifested. The work was thoroughly enjoyed, and to the authorities the writer is deeply grateful.

In this testing the Stanford Revision of the Binet-Simon Tests was used and the directions given by Terman were followed very closely. All responses were marked + or —. It was not possible to have a second person to keep a full record of all that the pupils said and did, but the examiner kept in his note-book as many as possible of the answers to the definitions, problem questions, difference between abstract words, and the interpretation of fables.

Age Comparison

No student below the age of 16 years was tested. Terman states that at this age the student has reached his maximum performance in the test, that is, after this stage of his development added years do not increase his intelligence quotient. The 75 white college students ranged from the age of 16 to 25 inclusive. However, these were unevenly distributed, the greater number lying at the lower end of the range. The median age for the entire number was 19.

The number and percentage of students at each age was as follows:

Age	16	17	18	19	20	21	22	23	24	25
Number	7	14	20	14	10	7	1	1	—	1
Per cent	9.3	18.7	26.7	18.7	13.3	9.3	1.3	1.3	0	1.3

It will be seen that 26.7% are 18 years of age; also, that there are just as many one year above the median age as there are one year below. It is interesting to note that only 4% were above the age of 21. Some of the students are retarded in their schooling, but it was practically impossible to ascertain

how many, or to what extent. Some entered college from the third year of the high school, while some entered from the fourth. Not a few spent one year or more out of school engaged in work, due to the demands of war, while many had seen military service. These circumstances would necessarily make any attempt to determine the amount of scholastic retardation futile.

The distribution of the ages of the 55 colored students was through a wider range—from 16 to 35 inclusive. The number and percentage for each year follows:

Age	16	17	18	19	20	21	22	23	24	25
Number	6	0	1	3	9	4	6	3	2	1
Per cent	10.9	—	1.8	5.5	16.4	7.3	10.9	5.5	3.6	1.8
(Continued)										
Age	26	27	28	29	30	31	32	33	34	35
Number	5	4	2	2	0	2	3	1	0	1
Per cent	9.1	7.3	3.6	3.6	—	3.6	5.5	1.8	—	1.8

The highest percentage of negroes found at any group was 16.4% at 20. The median for age is the same as the mode.

As with the whites it was impossible to determine the amount of school retardation. In fact, the task would have been even more difficult. A few of the students tested were found to have been out of school for as long as ten years before attempting to enter college. Due to the economic and social conditions under which they lived, they were forced to work some and then go to school. So varied were the causes that kept them from college, that no standards could be devised by which the amount of retardation could be determined.

The median age of the whites is two years less than the median age of the negroes, and the average age of the whites is five years less than that of the negroes.

The oldest negro is ten years older than the oldest white; 34.5% of the negroes are above the age of the oldest white, while only 10.9% lie below the median age of the whites. Also, 73.4% of the whites are below the median age for the negroes. From these comparisons it is evident that the negro college student is older than the white.

Comparison of Intelligence Quotients

According to Terman (16) The average intelligence quotient of college students should be 115, the highest possible score being 128. The average for the 75 white college students tested was 112. Many of the students passed two or more of the "Superior Adult Test," and had there been higher tests they might have increased their intelligence quotients.

Of the total number of white students 40% tested above 112, the average, while 57% tested below. More students tested

at 108 than at any other point, the number being 10, or 13% of the total. See table I, section A.

TABLE I

INTELLIGENCE QUOTIENTS OF WHITES AND NEGROES

(A) 75 White College Students			(B) 55 Negro College Students		
I. Q.	Number	Per Cent	I. Q.	Number	Per Cent
70– 80	0	0	70– 80	1	1.8
80– 90	0	0	80– 90	4	7.4
90–100	5	6.7	90–100	15	27.3
100–110	34	45.3	100–110	24	43.7
110–120	26	34.7	110–120	10	18.2
120–130	10	13.3	120–130	1	1.8
Average I. Q. = 112±6.			Average I. Q. = 103±7.8		

All the white college students tested at or above average intelligence. Of the 75 students 53% tested at average, and 47% above, 30.7% being between 105 and 110, 14.7% being between 100 and 105, and only one being below 100. Of the entire number 38.6% tested at superior intelligence and 14.7% at very superior.

When the intelligence quotients of the negro are analyzed the most striking thing is their wide distribution. They range from 76 to 125. The average for the negroes is 103 or 12 points below Terman's average intelligence quotient, and 9 points less than the average for the whites. The mean variation was 7.8.

Of the 55 tested, 9.2% tested below average intelligence. Thirty-nine or 71.0% tested between 90 and 110, average intelligence. However, there was a greater percentage in the upper half of this range, 23.6% having tested between 105 and 110, 16.4% between 100 and 105. Ten or 18.2% made a score of 108, the largest number at any one intelligence quotient. It is interesting to note further that 18.2% of the negroes tested at superior intelligence and 1.8% at very superior. A greater percentage of the negroes tested above average intelligence than below, 20.0% having tested above and 9.2% below.

More students from both races tested at 105-110 than at any other five-point group. Of all the whites 9.3% tested below the average for the negroes, 83.6% of the negroes tested below the average for the whites.

While the scale of intelligence quotients for the negroes extends lower than that of the whites, it ranges approximately as high. The highest score made by any colored student was 125; the highest made by any white student was 128. Odom

(5) looks upon this fact with optimism for the negro. He claims that the fact that the records of a limited number of negroes equal the records of the best whites gives indication of larger possibilities for the former.

It will be of interest to note the variability of the two races. Mayo (4) found that the negro was about 90% as variable as the white in scholastic attainment. In the present study the opposite is found to be the fact; the whites are only about 77% as variable as the negroes. This would indicate that we should expect to find more inferior people among the negroes than among the whites.

A comparison of the average intelligence quotients of the different age groups, and also of the mean variations is of interest at this point. The table below is a summary of the results obtained:

TABLE II

AVERAGE SCORE AND MEAN VARIATION OF EACH AGE GROUP

	(A) 75 White College Students			(B) 55 Negro College Students		
Age	Number	Average Score	Mean Variation	Number	Average Score	Mean Variation
16	7	110	6.6	6	114	4.7
17	14	110	5.1	0	0	0
18	20	113	5.4	1	94	0
19	14	111	7	3	109	2.3
20	10	111	4.8	9	102	5.1
21	7	113	5.6	4	100	10
22	1	108	0	6	95	8.3
23	1	100	0	3	99	9.3
24	0	0	0	2	104	0
25	1	111	0	1	107	0
26				5	102	5.4
27				4	109	3.5
28				2	110	2.5
29				2	105	2.5
30				0	0	0
31				2	106	5.5
32				3	94	8.3
33				1	94	0
34				0	0	0
35				1	108	0

No very pronounced difference exists between any age group. An 18 year old student made the lowest score of any of the whites, while the highest score was made by a student of 19. The mean variation of each age-group varies more than the average intelligence quotients of each group. The lowest is in the 20-year group where the average deviation is 4.8, the highest is in the 19-year group where it is 7.

A similar condition is noted among the negroes. However, the average score for each age-group of negroes varies through a wider range than does the average score for each age-group of whites. Also, the mean variation of the different groups vary widely, ranging from 2.3 to 10. See table II, section B.

One of the most outstanding facts is the comparative high score made by the 16-year old negroes. The average intelligence quotient of this group is two points higher than average for all the negroes, four points higher than the average for any other age-group of negroes one point higher than the average for any group of whites and two points higher than the average for all the whites. While the number is small the comparison is nevertheless interesting. The mean variation of the 16-year group of whites is higher than for the negroes, the figures being 6.6 and 4.7 respectively. The highest score made by any 16-year old white is 123, while the lowest is 101; the highest for the same age-group of negroes is 125, while the lowest is 107. It was a 16-year old student that made the highest score made by any negro student. The only other age group in which anything like a comparison can be made is the 20-year group. The average score of the negroes in this group is 102 with a mean variation of 5.7; the average score of the whites in this group is 111 with a mean variation of 4.8. However, when the average score of each age group of whites is compared with the average score of each similar age group of negroes it is found that in the main the whites rank higher than the negroes.

Correlation of School Success with Intelligence Quotients

Terman (15) classified the school success of 504 children into five grades: *very inferior, inferior, average, superior* and *very superior.* Similarly the college work of the 75 white students tested was classified. The grades for the making of this classification were secured from the Dean's Office of the University. The number and percentage in each group is here given in Table III.

TABLE III

COMPARISON OF SCHOOL AND TEST RATING (WHITE)

Group	No. Students	School Rating	Test Rating	Average Score	Mean Variation
Very Inferior	6	8%	0	106	2
Inferior	23	30.7	0	106	3.8
Average	18	24.	52%	113	3.6
Superior	17	22.7	34.7	113	5.9
Very Superior	11	14.6	13.3	121	4.5

When this grouping is compared with that made on the basis of the intelligence quotients it is seen that the agreement below the average school success is not very close. In fact no white college student tested below average intelligence, while 29 or 38.7% are doing inferior and very inferior college work. However, a majority are doing average to very superior college work, the number being 46, or 61.3% of the total. It would seem that the college work of the students is below their capacity, as revealed by the test.

It will be seen that the average score of each of the three lower school success groups is too high, but that the superior and very superior show a very close correlation. One rather striking fact brought out was that the subject that made an intelligence quotient below 100 is doing superior college work. However, the one that scored highest in the test is doing very superior college work. There are some rather serious disagreements. Many of those that are doing inferior to very inferior college work tested relatively high. But it must be remembered that school success rests on other factors than intelligence, such as application, quality of instruction, health, motive and interest. In spite of these considerations the correlation between school success and the intelligence quotients is high, it being .70 according to Pearson's formula (12).

The school success of the negroes was secured from the authorities of the two negro institutions. The number and percentage in each group is given in the following table. In the third column are the percentages determined by the tests.

TABLE IV

COMPARISON OF SCHOOL AND TEST RATING (NEGRO)

Group	No. Students	School Rating	Test Rating	Average Score	Mean Variation
Very Inferior.....	3	5.4%	1.8	99	9.7
Inferior.....	9	16.4	7.4	99	6.6
Average.....	15	27.3	70.	99	7.5
Superior.....	18	32.7	18.2	107	5.3
Very Superior.....	10	18.2	1.8	109	5.1

The above figures indicate that the school work of the negroes is given a higher rating by the teachers than it deserves. An interesting fact is that the percentage that tested above average intelligence is nearly identical with the percentage classed as doing average college work.

No difference at all is found in the average score of the three lower groups, each being 99. However, it will be seen that the very inferior group is more variable than the other

two groups. But the number is so small that the comparison could not at all be fair. Some rather serious disagreements are noted here. In only one group does the average score correspond to the classification based on school success, that is, the average group. But as a whole the correlation is found to be rather high, it being .50.

One important consideration must be borne in mind when a comparison is made between the two groups of students—the difference between the standard of the negro institutions and the standard of the white institution. According to the rating of the two negro institutions given in Bulletin 1916, No. 39, U. S. Bureau of Education, the standards required to be maintained by the negro students are inferior to those required to be maintained by the white students. On the other hand it is reasonable to suppose that the average negro who has the opportunity to attend college puts forth greater effort than the average white student, which may account for the fact that the negro's school work receives a rating superior to his intelligence quotient, whereas the white student's school work is inferior to his intelligence quotient.

In every school success group the average intelligence quotients of the whites is greater than that of the negroes, and the mean variation is less except in the superior group in which it is .6 higher. Further there is a lower degree of correlation between the school success and intelligence of the negroes than there is between the school success and intelligence of the whites.

Correlation of Environment with Intelligence Quotients

In making a comparison of the environments of the two races with the intelligence quotients it must be kept in mind that the average environment of the negro is much inferior to that of the white. The environment that would be considered average or even inferior for the white, would be considered superior for the negro. However, this fact will not prevent the making of some interesting comparisons.

The environments of the whites were classed into five groups; namely, *very inferior, inferior, average, superior* and *very superior*. Of the 75 tested, not one was found to have very inferior environment. The greatest percentage was found in the average group, there being 45.3%. Only 8% were classed as inferior; 36% were in the superior group and 10.7% in the very superior. Combining these figures we have 46.7%of the white college students from above average environment, with only 8% below.

When the intelligence quotients of the environmental groups are analyzed it is found that there is a rather high degree of correspondence. The coefficient of correlation is .85. Each higher environmental group has a higher average intelligence quotient than the preceding one. A summary of the results is given in table V.

TABLE V

COMPARISON OF ENVIRONMENTAL AND TEST RATING (WHITE)

Group	No. Students	Environ. Rating	Test Rating	Average Score	Mean Variation
Very Inferior.....	0				
Inferior.....	6	8%	0	103	5.7
Average.....	34	45.3	52.	111	5.9
Superior.....	27	36.	34.7	112	5.4
Very Superior.....	8	10.7	13.3	118	4.0

The mean variation of each group does not vary widely from the variation of every other group. The smallest is in the very superior group, meaning that the students in this group test very superior to a greater degree than those in the superior environmental group test superior, those in the average group test average or those in the inferior group test inferior.

When the colored students were classified as to environment, none was found in the very inferior group, 7.3% were in the inferior group, 23.6% in the average, 52.7% in the superior and 17.3% in the very superior. It is a rather a striking fact that a comparatively small percentage of the negro students are classed as being from inferior or average environment, there being 70% from above the average negro environment. This seems to indicate that only those negroes from the best homes and most progressive communities go to college to any extent.

When the environment is correlated with the intelligence quotients the agreement is found to be rather close, the coefficient of correlation being .70. A summary of the results is given below in table VI.

TABLE VI

COMPARISON OF ENVIRONMENTAL AND TEST RATING (NEGRO)

Group	No. Students	Environ. Rating	Test Rating	Average Score	Mean Variation
Very Inferior.....	0		1.8		
Inferior.....	4	7.3%	7.4	98	8.0
Average.....	13	23.6	70.0	99	8.2
Superior.....	29	52.7	18.2	104	6.0
Very Superior.....	9	17.3	1.8	110	6.6

The superior environmental group shows less variability than any other, while the average group shows the greatest. However, the range of the group variation is not very wide, it being from 6 to 8.2.

In every environmental group the average score of the white students is higher than that of the negroes and the mean variation is less. The negro college student is from a better negro environment than the white is from a white environment. Seventy per cent of the negroes are from above the average environment, while only 46% of the whites are from such. This indicates that white boys from the average white environment go to college nearly twice as frequently as do the negro boys from the average negro environment.

There is a higher degree of correlation between the environment and the intelligence quotients of the whites than there is between the environment and intelligence quotients of the negroes, the coefficients being .85 and .70 respectively.

The conclusions reached here are in accord with those of the other investigators in this field. Pyle (2) says that the good social group of the negroes stands about midway between the poor social group and the good social group of the whites. Ferguson (1) states that the negro boy from a good social group makes about three-fourths the showing of the white. Odom (5) and Phillips (8) in the main, corroborate this. Odom (5) say that "it would be clearly impossible for the negro to show the same manifestations of mental traits as whites after having been under the influence of an entirely different environment for many generations,"

Specific Differences

The responses of both races, both successes and failures, correspond to the specimen answers given by Terman (16) and others. The percentage of white and colored students that passed each specific test is given below for both races in table VII.

TABLE VII

	Negroes	Whites
YEAR XIV	55	75
Vocabulary, 50 words	87%	99%
Induction Test	78	96
Difference between President and King	96	92
Problems of Fact	95	99
Arithmetical Reasoning	89	99
Reversing Hand of Clock	75	85

TABLE VII—*Continued*

	Negroes	Whites
YEAR XVI	54	75
Vocabulary, 65 words	46%	60%
Interpretation of Fables	75	82
Difference between Abstract Words	89	74
Repeats 6 Digits Reversed	51	54
Code	22	60
YEAR XVIII	38	74
Vocabulary, 75 words	5%	21%
Binet's Paper Cutting Test	49	82
Repeats 8 Digits	29	32
Repeats Thought of Passages	10	44
Repeats 7 Digits Reversed	15	18
Ingenuity Test	25	63

Year XIV.

The negroes were more successful in giving the difference between a president and a king than in any other test, 96% giving at least two of the three differences correctly. Also the negroes did well with the problems of fact, 95% passing it correctly. Of all the tests in this group they did poorest in changing the hands of the clock. Sunne (13) also found this condition and suggests that it may be due to the lack of acquaintance with a timepiece. This, however, is hardly true for college negroes, who, as we have seen, come from superior negro environment. More probably it is due to the inability to reason the problem out.

Practically all the white students were able to pass all the tests of this group. Reversing the hands of the clock was found to be the most difficult, 85% being able to pass it. Over 90% were able to pass the other tests.

Year XVI

This group was not given to one of the negroes, due to the fact that he failed to pass more than one of the tests in the preceding year group. The negroes were most successful in giving the difference between abstract words, 89% having been able to pass this test. They were least successful with the code, only 22% doing it well enough to make a pass. They were also rather successful in the interpretation of fables, 75% interpreting four of the five correctly.

The interpretation of fables proved to be the easiest for the whites in this group, 82% passing it; while repeating six digits reversed proved to be the most difficult with 54% repeating them correctly.

Year XVIII

The greatest success was with Binet's paper cutting test, 49% of the negroes doing it correctly. It is a rather striking fact that only 5% were able to pass the vocabulary test of this group.

Binet's paper cutting test proved easiest also for the whites, 82% passing it. The repeating of seven digits reversed was the most difficult, only 18% repeating them correctly.

In every test the percentage of passes registered by the whites is greater than the percentage registered by the negroes, except in giving the difference between a president and a king, where the negroes excelled the whites by 4%; and giving the difference between abstract words, where the whites are excelled by 15%. This would seem to indicate that the negro is superior to the white in discrimination and abstraction. However, it seems reasonable to suppose that in the giving of the difference between abstract words the peculiar training of the negro has determined his success. It has been drilled into him by his teachers that there is a decided difference between *poverty* and *misery, laziness* and *idleness,* and *reputation* and *character.* No doubt that training also enters into his success in the interpretation of fables. It is characteristic for the negro to teach and preach by the use of moralizing stories and fables.

The conclusion of Pressey and Teter (9) that the negro is better in concrete and routine problems than in problems involving mental abstractions or reconstruction is found to be generally true in this study. The conclusion of Sunne (13) that colored children find it difficult to reverse the hands of the clock is corroborated, but his conclusion that the problems of fact were difficult is not. The code was not found to be easier for the negroes than for the whites as is stated by the same investigator. The conclusion of Phillips (8) that the negro is slower in response and less animated was not corroborated by this study. Sunne (13) could find no such difference.

One of the most striking things brought out in the testing of the negroes was the answers given to the first problem in the "Problems of Fact" test. Fifty per cent of them either said that a man was lynched or a man was shot by a mob. Very few such answers were given by the white students. This fact would tell an interesting story to a psycho-analyst.

Summary

1. The negro college student is older than the white; and according to chronological age he is more retarded.

2. The white college students have a higher average intelligence quotient than the negroes, their average score being 9 points higher.

3. The range of the intelligence quotients of the negroes was wider than that of the whites, the range of the former was from 76 to 125 and that of the latter was from 91 to 128.

4. The white college student was about 77% as variable as the negro.

5. The average intelligence quotient of the 16 year old negroes is higher than average for any other age group of either race.

6. The college work of the white college student is inferior to his ability as measured by the test.

7. The college work of the negroes is given a higher rating by the teachers than it deserves according to the test.

8. In every school success group the average intelligence quotient of the whites is higher than that of the negroes, and the mean variation is less in every group except in the superior group where it is .6 higher.

9. There is lower degree of correlation between the school success and intelligence quotients of the negroes than between the school success and intelligence quotients of the whites; the coefficient of correlation of the former being .50, that of the latter being .70.

10. In every environmental group the average score of the whites is higher than that of the negroes, and the mean variation is less.

11. White boys from average environment go to college nearly twice as frequently as negro boys from average negro environment.

12. There is a higher degree of correlation between the environment and intelligence quotients of the whites than there is between the environment and intelligence quotients of the negroes, the coefficients of correlation being .85 and .70 respectively.

13. From this study it seems that the negro is better in memory and in concrete and routine problems than in those that involve mental abstraction and reconstruction.

Bibliography

1. Ferguson, G. C. Jr. The Psychology of the Negro. *Archives of Psychology*, No. 36, April, 1916.
2. Gatewood, E. L. Teacher's Estimates of Negroes and Whites. *School and Society*, Vol. IX, 1919, pp. 89-90.
3. Redfern, L. H. and Rich, S. G. Binet Tests on South African Natives—Zulus. *Pedagogical Seminary*, Vol. XXIV, 1917, No. 3, pp. 373-383.
4. Mayo, W. J. The Mental Capacity of the American Negro. *Archives of Psychology*, No. 28, November, 1913.
5. Odom, H. W. Negro Children in the Public Schools of Philadelphia. *American Academy of Political and Social Science*, Vol. XLIX. pp. 186-208.
6. Perring, L. F. A Study of the Comparative Retardation of Negro and White Pupils in a Philadelphia School. *Psychological Clinic*, Vol. IX, No. 3, pp. 87-93.
7. Phillips, B. A. Retardation in the Elementary Schools of Philadelphia. *Psychological Clinic*, Vol. VI, No. 3, pp. 79-81.
8. ——— The Binet Tests Applied to Colored Children. *Psychological Clinic*, Vol. VIII, No. 7, pp.190-197.
9. Pressey, S. L. and Teter, G. F. A Comparison of Colored and White Children by Means of a Group Scale of Intelligence. *Journal of Applied Psychology*, Vol. III, 1919. No. 3, pp. 279-282.
10. Pyle, W. H. The Learning Capacity of the Negro. *Psychological Bulletin*, Vol. XIII, 1916, pp. 82-83.
11. Pyle, W. H. The Mentality of the Negro Compared with the Whites. *Psychological Bulletin*, Vol. XII, p. 71.
12. Starch, Daniel. *Experiments in Educational Psychology*. The Macmillan Company, New York, 1919.
13. Sunne, Dagny. A comparative Study of Negro and White Children. *Journal of Applied Psychology*, Vol. I, 1917, No. 1, pp. 71-84.
14. Strong, A. C. Three Hundred Fifty White and Colored Children Measured by the Binet-Simon Scale of Intelligence: A Comparative Study. *Pedagogical Seminary*, Vol. XX, 1913, pp. 485-515.
15. Terman, L. M. and others. Stanford Revision Binet-Simon Scale and Some Results from its Application to 1,000 Non-Selected Children. *Journal of Educational Psychology*, Vol. VI. 1915. No. 9, pp. 551-562.
16. Terman, L. M. The Measurement of Intelligence. Houghton Mifflin Company, New York, 1916.
17. ——— Some Suggestions Relative to the Study of the Mental Attitude of the Negro. *Pedagogical Seminary*, Vol. XXI, 1914, No. 1, pp. 199-203.
18. Woodworth, R. S. Comparative Psychology of the Races. *Psychological Bulletin*, Vol. XIII, 1916, pp. 388-396.

THE EFFECT OF CLIMAX AND ANTICLIMAX ORDER OF PRESENTATION ON MEMORY

By Henry Foster Adams, University of Michigan

In previous papers,[1] the memory efficiency of size of advertisements, of their frequency of presentation with both duplication and variation, and of mixed sizes of advertisements, have been discussed. In the last paper mentioned, it was found that the memory value of the same total amount of space varied as it was made up of different combinations of sizes. For instance a series made up of 3 half and 1 quarter page advertisements of the same commodity was found to have a greater memorability than a similar series composed of 1 full and 3 quarter pages, yet the total area is the same in both cases, 1.75 pages, and the number of presentations is 4 in each case.

But a question which was left unsolved in that experiment was whether the order in which the mixed sizes were presented to the subject had any effect upon the memorability of the series. For example, if a firm advertises 4 times with mixed sizes of advertisements, is it more effective upon memory to present the larger sized advertisements at the beginning or end of the series.

To test the point 3 dummies were prepared, as follows. In dummy A, for instance, each firm advertised 4 times, the different insertions being variations and at least two sizes of advertisements being included in the 4 insertions. Each different arrangement of sizes was likewise represented by four different firms. With two of the firms, the larger sizes appeared first, followed by the smaller ones and with the other two firms for the same combination of sizes, the advertisements of smaller area appeared first, followed by the larger ones. In all, the following combinations were presented:—

[1] The Relative Importance of Size and Frequency in Forming Associations, *J. of Phil., Psy., and Sci. Meth.*, Vol. XII, 1915, pp. 477-491.
The Relative Memory and Values of Duplication and Variation in Advertising, *ibid.*, Vol. XIII, 1916, pp. 141-152.
The Memory of Mixed Sizes of Advertisements, *J. of Exper. Psychol.* Vol. II, 1917, pp. 448-465.

Dummy	A	B	C	
FFFH	2	2	2	
HFFF	2	2	2	
FFFQ	2	2	2	
QFFF	2	2	2	
FFHH	2	2	2	
HHFF	2	2	2	
FFQQ	2	2	2	
QQFF	2	2	2	
FFHQ	2	2	2	
QHFF	2	2	2	
FHHH	2	2	2	
HHHF	2	2	2	
FQQQ	2	2	2	
QQQF	2	2	2	
FHHQ	2	2	2	
QHHF	2	2	2	
FHQQ	2	2	2	
QQHF	2	2	2	
HHHQ	2	2	2	
QHHH	2	2	2	
HHQQ	2	2	2	
QQHH	2	2	2	
HQQQ	2	2	2	
QQQH	2	2	2	
	48	48	48	144

In the experiment, part of the subjects began reading the dummy at page 1 and went along progressively to the end; others began at the end and read back to page 1. This was easily accomplished by turning the dummy upside down. Therefore, to those subjects who read the dummy through in the forward direction, the advertisements of a certain firm would be seen in the order FFFH; while to those who read it through in the reverse direction, the same advertisements of the same firm would appear in the order HFFF. In this way each series of advertisements was seen by the subjects in both the climax and anti-climax order. For the sake of convenience of expression, the series of advertisements is said to be in the climax order if the smaller spaces appear first followed by the larger ones; in the anti-climax order if the larger spaces are seen first followed by the smaller ones.

With dummy A, 93 subjects were used in the direct or forward order of reading, 68 in the reverse order; in dummy B 95 in the direct order, 58 in the reverse; in dummy C 79 in the forward order and 70 in the reverse order. This makes a total of 463 subjects.

Since the results of the experiments may be considered in several ways and the conclusions to be drawn from the experiment depend in part upon the method of treatment, the original data will be presented. It is given in Table I.

TABLE I

Order of Ads.	Dummy A				Dummy B				Dummy C			
	D	R	Ant	Cli	D	R	Ant	Cli	D	R	Ant	Cli
FFFH.....	137	103	137	103	53	29	53	29	92	76	92	76
	78	64	78	64	48	21	48	21	48	52	48	52
HFFF.....	70	65	65	70	49	30	30	49	72	71	71	72
	70	53	53	70	58	34	34	58	69	92	92	69
			333	307			165	157			303	269
FFFQ.....	74	56	74	56	49	26	49	26	76	81	76	81
	121	82	121	82	38	18	38	18	84	71	84	71
QFFF.....	104	86	86	104	36	11	11	36	32	34	34	32
	51	37	37	51	53	28	28	53	52	49	49	52
			318	293			126	133			243	236
FFHH.....	55	42	55	42	44	22	44	22	66	81	66	81
	71	62	71	62	50	22	50	22	17	35	17	35
HHFF.....	91	66	66	91	83	50	50	83	22	37	37	22
	110	91	91	110	23	11	11	23	87	89	89	87
			283	305			155	150			209	225
FFQQ.....	23	22	23	22	57	15	57	15	87	101	87	101
	115	87	115	87	57	29	57	29	95	81	95	81
QQFF.....	28	39	39	28	33	22	22	33	107	113	113	107
	32	38	38	32	100	61	61	100	35	47	47	35
			215	169			197	177			342	324
FFHQ.....	77	51	77	51	27	5	27	5	22	22	22	22
	57	45	57	45	114	54	114	54	36	57	36	57
QHFF.....	76	61	61	76	30	15	15	30	89	95	95	89
	36	30	30	36	37	17	17	37	55	67	67	55
			225	208			173	126			220	223
FHHH.....	60	41	60	41	59	26	59	26	18	27	18	27
	65	36	65	36	101	61	101	61	118	110	118	110
HHHF.....	88	57	57	88	18	7	7	18	106	91	91	106
	60	63	63	60	55	27	27	55	61	53	53	61
			245	225			194	160			280	304
FQQQ.....	70	68	70	68	65	30	65	30	25	23	25	23
	24	10	24	10	45	10	45	19	59	61	59	61
QQQF.....	81	28	28	31	74	43	43	74	44	65	65	44
	50	36	36	50	52	21	21	52	96	87	87	96
			155	159			174	175			236	224
FHHQ.....	27	26	27	26	24	10	24	10	59	62	59	62
	33	26	33	26	105	43	105	43	41	50	41	50
QHHF.....	50	49	49	50	63	34	34	63	104	83	83	104
	9	12	12	9	13	8	8	13	35	46	46	35
			121	111			171	129			229	251
FHQQ.....	42	38	42	38	37	21	37	21	77	78	77	78
	60	40	60	40	97	48	97	48	92	88	92	88
QQHF.....	91	84	84	91	29	17	17	29	52	70	70	52
	35	40	40	35	66	28	28	66	12	15	15	12
			226	204			179	164			254	230

TABLE I—*Continued*

Order of Ads.	Dummy A				Dummy B				Dummy C			
	D	R	Amt	Cli	D	R	Ant	Cli	D	R	Ant	Cli
HHHQ.....	72	54	72	54	16	4	16	4	64	50	64	50
	58	40	58	40	20	14	20	14	66	62	66	62
QHHH.....	21	22	22	21	79	30	30	79	62	65	65	62
	24	15	15	24	33	19	19	33	31	51	51	31
			167	139			85	130			246	205
HHQQ.....	5	10	5	10	8	6	8	6	39	52	39	52
	71	46	71	46	71	23	71	23	30	45	30	45
QQHH.....	11	10	10	11	48	16	16	48	86	79	79	86
	11	10	10	11	16	8	8	16	36	28	28	36
			106	78			103	93			166	219
HQQQ.....	9	12	9	12	18	5	18	5	18	22	18	22
	17	8	17	8	87	47	87	47	15	25	15	25
QQQH.....	12	23	23	12	18	9	9	18	65	37	37	65
	5	10	10	5	83	46	46	83	17	22	22	17
			59	37			160	153			92	129

The column of initials at the left gives the order of presentation of the advertisements, F standing for full page, H for half page and Q for quarter page. The second, labeled D, gives the gross credits received by the various series of advertisements when the subjects read in the forward or direct order, starting at page 1. The third column, labeled R gives the gross credits received by the advertisements when the dummy was read through in the reverse direction. The fourth column, headed by Ant. gives the credits for the advertisements which were read through in the anti-climax order; and in the fifth column, headed Cli. the credits for those advertisements which were read through in the climax order. The other columns gives the same data for dummies B and C.

TABLE II

	Dummy A		Dummy B		Dummy C		Total	
	Anti	Cli	Anti	Cli	Anti	Cli	Anti	Cli
FFFH.....	333	307	165	157	303	269	801	733
FFFQ.....	318	293	126	133	243	236	687	662
FFHH.....	283	305	155	150	209	225	647	680
FFQQ.....	215	169	197	177	342	324	754	670
FFHQ.....	225	208	173	126	220	223	618	557
FHHH.....	245	225	194	160	280	304	719	689
FQQQ.....	155	159	174	175	236	224	565	558
FHHQ.....	121	111	171	129	229	251	521	491
FHQQ.....	226	204	179	164	254	230	659	598
HHHQ.....	167	139	85	130	246	205	498	474
HHQQ.....	106	78	103	93	166	219	375	390
HQQQ.....	59	37	160	153	92	129	311	319
	2453	2235	1882	1747	2820	2839	7155	6821
							105	: 100

In Table II, a summary of the climax and anti-climax effects

is given, indicating that the anti-climax order of presentation is somewhat more effective as far as memory is concerned.

But it must be remembered that these are gross figures and furthermore that unequal numbers of subjects were used in the forward and backward turning of the pages of the dummy. To compensate for this the credits for each advertisement were put into percentages which were multiplied

TABLE III

Order of Ads.	A				B				C			
	D	R	Ant	Cli	D	R	Ant	Cli	D	R	Ant	Cli
FFFH	529	494	529	494	218	244	218	244	332	262	332	262
HFFF	302	306	302	306	198	176	198	176	174	179	174	179
	270	312	312	270	201	252	252	201	259	245	245	259
	270	254	254	270	238	286	286	238	248	318	318	248
			1397	1340			954	859			1069	948
FFFQ	286	268	286	268	202	218	202	218	275	280	275	280
	466	393	466	393	156	151	156	151	304	245	304	245
	402	412	412	402	148	92	92	148	108	118	118	108
	198	177	177	198	218	235	235	218	187	170	170	187
			1341	1261			685	735			867	820
FFHH	213	201	213	201	181	185	181	185	238	280	238	280
HHFF	275	296	275	296	206	185	206	185	61	121	61	121
	352	316	316	352	341	420	420	341	79	128	128	79
	425	435	435	425	94	92	92	94	314	308	308	314
			1239	1274			899	805			735	794
FFQQ	89	102	89	102	235	126	235	126	314	350	314	350
QQFF	445	415	445	415	235	244	235	244	344	280	344	280
	104	187	187	104	135	185	185	135	385	390	390	385
	124	182	182	124	410	512	512	410	126	163	163	126
			903	745			1167	915			1211	1141
FFHQ	298	244	298	244	106	42	106	42	79	76	79	76
QHFF	221	215	221	215	469	454	469	454	130	196	130	196
	293	293	293	293	123	126	126	123	320	338	338	320
	149	144	144	149	152	143	143	152	199	232	232	199
			956	901			844	771			779	791
FHHH	232	198	232	198	243	218	243	218	65	93	65	93
HHHF	251	172	251	172	420	511	420	511	426	380	426	380
	340	264	264	340	74	59	59	74	381	315	315	381
	232	302	302	232	226	227	227	226	219	183	183	219
			1049	942			949	1029			989	1073
FQQQ	270	325	270	325	268	251	268	251	90	80	90	80
QQQF	93	48	93	48	185	159	185	159	214	210	214	210
	119	134	134	119	304	362	362	304	158	224	224	158
	193	172	172	193	214	177	177	214	345	301	301	345
			669	685			992	928			829	793
FHHQ	102	124	102	124	99	84	99	84	214	213	214	213
QHHF	128	124	128	124	431	362	431	362	148	172	148	172
	193	234	234	193	259	285	285	259	374	287	287	374
	35	58	58	35	53	67	67	53	126	159	159	126
			522	476			882	758			808	885

TABLE III—*Continued*

Order of Ads.	A				B				C			
	D	R	Ant	Cli	D	R	Ant	Cli	D	R	Ant	Cli
FHQQ	162	182	162	182	152	176	152	176	278	269	278	269
	232	191	232	191	398	403	398	403	332	303	332	303
QQHF	351	403	403	351	119	143	143	119	187	242	242	187
	135	191	191	135	271	235	235	271	43	52	52	43
			988	859			928	969			904	802
HHHQ	279	258	279	258	66	33	66	33	231	172	231	172
	224	191	224	191	82	117	82	117	239	213	239	213
QHHH	81	103	103	81	324	252	252	324	223	225	225	223
	93	72	72	93	135	160	160	135	111	176	176	111
			678	623			560	609			871	719
HHQQ	20	48	20	48	33	50	33	50	141	179	141	179
	274	220	274	220	292	193	292	193	108	155	108	155
QQHH	42	48	48	42	197	135	135	197	300	273	273	301
	42	48	48	42	66	67	67	66	129	97	97	129
			390	352			527	506			619	764
HQQQ	35	57	35	57	74	42	74	42	65	76	65	76
	66	38	66	38	358	394	358	394	54	86	54	86
QQQH	46	110	110	46	74	76	76	74	234	128	128	234
	19	48	48	19	340	387	387	340	61	76	76	61
			259	160			895	850			323	457

by 100 to avoid the use of decimal points. This data is presented complete in Table III, and in summarized form in Table IV. Again we have a suggestion that the anti-climax order is somewhat more efficient than in the climax.

TABLE IV

	Dummy A		Dummy B		Dummy C		Total	
	Anti	Cli	Anti	Cli	Anti	Cli	Anti	Cli
FFFH	1397	1340	954	859	1069	948	3420	3147
FFFQ	1341	1261	685	735	867	820	2893	2816
FFHH	1239	1274	899	805	735	794	2873	2873
FFQQ	903	745	1167	915	1211	1141	3281	2801
FFHQ	956	901	844	771	779	791	2579	2463
FHHH	1049	942	949	1029	989	1073	2987	3044
FQQQ	669	685	992	928	829	793	2490	2406
FHHQ	522	476	882	758	808	885	2212	2119
FHQQ	988	859	928	969	904	802	2820	2630
HHHQ	678	623	560	609	871	719	2109	1951
HHQQ	390	352	527	506	619	764	1536	1622
HQQQ	259	160	895	850	323	457	1477	1467
							30677	29339
							105 : 100	

But again a difficulty of interpretation creeps in and this time it comes from the sheer magnitude of the figures themselves. The difference between 66 and 33 for instance is 33 or 100%; the difference between 540 and 507 is again 33 but only about 6%. There is to be found in the figures a dif-

TABLE V

	A	B	C	Total	Sum	Av.
FFFH.....	1071	895	1268	3234		
	988	1131	973	3092		
	1155	1253	947	3355		
	942	1201	1281	3424		
					13105	3276
FFFQ.....	1068	928	982	2978		
	1188	1032	1241	3461		
	1025	621	1092	2738		
	895	1079	910	2884		
					12061	3015
FFHH.....	1060	978	850	2888		
	930	1113	504	2547		
	899	1232	1621	3752		
	1022	980	983	2985		
					12172	3043
FFQQ.....	874	1866	897	3637		
	1072	965	1228	3265		
	1800	1370	1012	4182		
	1469	1249	1292	4010		
					15094	3774
FFHQ.....	1221	2528	1040	4789		
	1028	1034	664	2726		
	1000	1023	1058	3081		
	967	941	1165	3073		
					13669	3417
FHHH.....	1171	1114	700	2985		
	1460	822	1121	3403		
	778	798	827	2403		
	1301	1004	837	3142		
					11933	2983
FQQQ.....	832	1069	1125	3026		
	1939	1164	1020	4123		
	1127	1191	1419	3737		
	892	827	873	2592		
					13478	3370
FHHQ.....	823	1180	1005	8008		
	1032	1190	861	3083		
	1213	1100	767	3080		
	1655	1265	1261	4181		
					13352	3338
FHQQ.....	889	865	1031	2785		
	1214	987	1095	3296		
	1150	1200	1292	3642		
	1413	866	1210	3489		
					13212	3303
HHHQ.....	1080	2000	1342	4422		
	1172	700	1122	2994		
	1274	778	1010	3062		
	3574	1186	1586	3546		
					14024	3506

TABLE V—*Continued*

	A	B	C	Total	Sum	Av.
HHQQ.....	417	660	788	1865		
	1245	1510	697	3452		
	1142	685	907	2734		
	1142	1015	750	2907		
					10958	2739
HQQQ.....	614	1760	855	3229		
	1736	910	629	3275		
	2390	1028	548	3966		
	2522	1138	1246	4906		
					15376	3844
Sums and Av. of Averages					1100	3301
					1100	1100

ference between the absolute amount and the relative amount of influence resulting from the changing order of presentation.

Table of Ratios. The climax order is given an arbitrary value of 1,000 and the anti-climax a relative value. Since the climax order has always the value 1,000, it is omitted from the table. Table V was prepared, in which the anti-climax values are given in ratios, the climax order of presentation

TABLE VI

Anti-climax ratios put in the form of a frequency table.

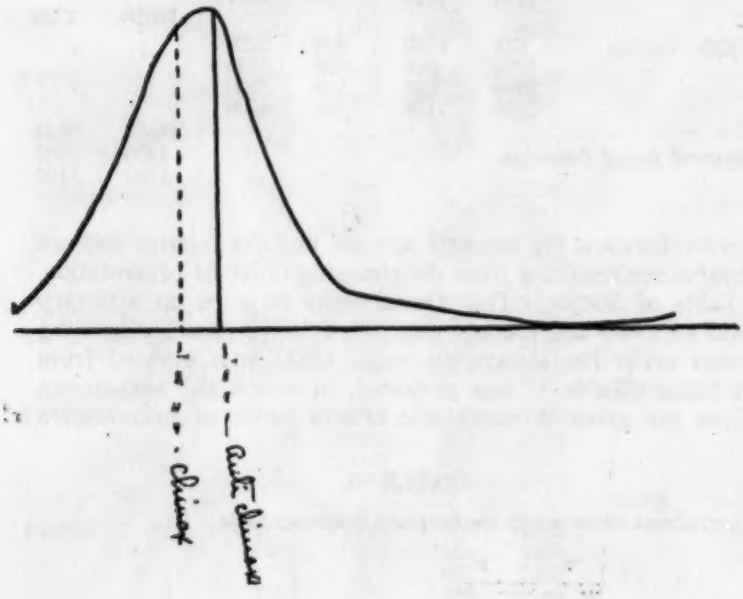
V	F
40–59	3
60–79	15
80–99	37
100–119	49
120–139	23
140–159	6
160–179	4
180–199	3
200–219	1
220–239	1
240–259	2

Av. = 111.11
A. D. = 22.67
n = 144
P. E. = 1.6-

having an arbitrary value of 1,000. This table in summary indicates that the anti-climax order is 10% more effective than the climax order, and this fact is emphasized by throwing the anti-climax values into a table of frequency as is done in Table VI. This method of presenting the data gives the anti-climax order a value of 11 + % advantage over the climax. The probable error is very low, only 1.6, approxi-

mately 1-7 of the significant difference. It may be concluded then, that the anti-climax order is more effective than the climax order.

GRAPH DRAWN FROM TABLE VI



THE SELECTION OF MILL WORKERS BY MENTAL TESTS.

By Arthur S. Otis, Camp Grant, Ill.

The extended use of intelligence testing in the United States Army has given psychology—mental testing in particular—a widespread interest. It has come to the attention of many progressive industrial managers that a number of psychologists have been engaged for a number of years in research in the making and perfecting of tests for industrial employees, especially salesmen and clerks. The success of their work is attested to by the continued and extended use of their tests. The natural inference of both psychologists and industrial managers has been that ultimately psychological tests would be used to assist in choosing factory and mill workers.

The writer was called at the close of his army service (Jan. 1919) to the office of a large and progressive silk manufacturing company in Connecticut to "install a system of mental tests for prospective employees," (both clerks and mill workers). Bringing to bear his experience in mental testing in the army and schools the writer constructed two systems of intelligence tests, one for clerks and executives, similar to the Otis General Intelligence Examination, and a comprehensive performance intelligence examination somewhat similar to the performance tests used in the army for foreigners and illiterates. This latter was for all mill workers, a large percentage of whom were foreign or illiterate.

The clerical intelligence test proved to be of decided value in the selection of members of the office force and has been adopted for permanent use. It is not the purpose of this article to discuss this test.

The results of an extended tryout of the performance intelligence examination, however, are both startling and baffling and cast an ominous shadow over the future of strictly intelligence tests for manual workers.

The performance scale used in this connection consisted of 13 tests covering a wide range of mental and manual activity. The examination of an individual lasted on the average an hour. In all some 400 employees were tested. These were placed in three groups according to their productive ability

ascertained by careful investigation. In the last analysis it was found that the correlation between intelligence and productive ability was zero! No amount of age grouping or length of service grouping would bring anything but zero out of the correlations.

That the tests did measure intelligence one may be perfectly confident, first because for the most part they were standard tests which have been used in one form or another for years—picture puzzle, drawing designs, paper folding, etc. The ability of clerks in these tests were found to be distinctly above that of mill workers as a class. Secondly the intercorrelations between the several tests ranged between .40 and .75 denoting a "reliability coefficient" for the whole scale of .97. When 13 widely varying tests tend strongly to measure the same ability that ability must be "general ability" or intelligence.

The writer is not prepared to say that it is proven conclusively that there is no correlation between intelligence and efficiency in mill work, for various reasons. It cannot be asserted confidently that every examinee did his best on the tests. There was lacking the incentive that is present when an applicant seeks employment. These examinees were already employed and saw no purpose in the tests. Moreover, the rating in productive ability was not as refined as could be desired due to numerous difficulties which could not be overcome in making the ratings. Furthermore, it was not possible to test such individuals as had failed to learn to weave or spin or be worth employing in some branch of the industry. These might have shown a lesser intelligence as a group.

On the other hand the difficulties above mentioned are only such as would be expected to "attenuate" the correlations—to reduce the true correlations to, say, one half or less. But a correlation must be pretty small in the first place if one half or one third of it equals zero! We are forced to conclude therefore that intelligence is a very unimportant factor in efficiency in silk mill work.

The psychologist can hardly rest content with such a conclusion without some sort of explanation, considering the known correlation between intelligence and clerical ability or executive ability or scholastic ability, military ability, etc. The following is suggested as a possible explanation.

Firstly, the machinery of the present day is so efficient and automatic that very little intelligence is needed to use it. Moreover, machine work is so specialized and monotonous that an intelligent person is very likely to revolt at it after a moderate period. The writer met one person who said she had sat in

the same chair every work day for 18 years at her occupation of pasting strips of white paper around the edges of cardboard boxes. Yet she seemed entirely contented with the work and said she liked it. Some weavers had worked in the same mill for 35 years. Many persons do nothing but put full spools of silk in place of empty ones, week after week, year after year, with seeming contentment. Others do nothing but cut imperfections from thread and tie the ends—the imperfections being located by electric machinery automatically. Others do nothing but tie knots in breaking thread. Weaving is perhaps the most skilled operation in the mill. The operation of a loom is probably no more complicated than the operation of an automobile, yet three months are devoted to teaching a "weaver learner." It would seem that almost any degree of intelligence could be taught in that time to thread bobbins, tie knots, watch for imperfections, etc. The man who was considered the best weaver in the mill, having never failed to "make bonus" for a long period, took something like ten minutes to assemble the parts of a simple picture puzzle of twelve square pieces which intelligent persons had assembled in 25 seconds, and he was then satisfied to leave the ear under the chin. Another good weaver could not put the mouth under the nose in 25 minutes!

The conclusion which the writer draws from these researches is that intelligence is not only not required in a modern silk mill for most operations but may even be a detriment to steady efficient routine work. What qualities are required remain to be sought. Whether they are measurable is doubtful. They may be stolidity, patience, inertia of attention, regularity of habits, etc.

The field of industrial psychology as applied to manual labor is believed by the writer to be virgin soil.

THE COMMON SYNAESTHESIA OF MUSIC

By E. Leigh Mudge, State Normal School, Edinboro, Pa.

Synaesthesia, the reaction of one sense to the adequate stimulus of another sense, is not so uncommon as is often supposed. It is true that the very noticeable types commonly described are relatively rare, though even these are found by a recent writer to appear in from 9 to 15 per cent. of adults and in 25 per cent. of adolescents.[1] Like most tendencies in nature, synaesthesia appears in many degrees of variation. It is not a clearly-cut type of abnormality. It is, in fact, too common to be called an abnormality at all. Like any tendency, it is found in abnormal and extreme cases, but it has no absolutely definable lower limit. It is theoretically doubtful if any sense reaction takes place in absolute isolation from other senses. In the case of any meaningful experience of vision or audition, sight or hearing is the key that unlocks a complex of sensations or images or both in terms of a variety of senses, especially the deep-seated organic and strain senses and others intimately involved in feeling and emotive processes.

Doubtless there is a closer connection between either vision or audition and the deep-seated intimate senses than between these two articulative senses themselves. However, it is not strange if there be some tendency, with individual variations, to connect visual imagery with auditory stimuli. Various unusual cases of "colored hearing" and other inter-associations of vision with hearing have been reported. Reports from fifty mature students, chiefly active public school teachers, seem to indicate that the unusual cases represent an uncommon development of a common tendency. These fifty students were asked to report the colors or brightnesses which they associate with certain tones, keys, instruments, and familiar musical compositions. Only eight reported a total lack of such associations. While there is little uniformity as to particular color associations, some tentative generalizations appear warranted by these reports.

[1] Wheeler, Raymond H., The Synaesthesia of a Blind Subject, *University of Oregon Publications*, Vol. I, No. 5, May, 1920, p. 32.

1. *A low tone.* Thirty-four persons associate low tones with dark colors or grays. Fourteen associate no color or brightness with low tones. One associates with medium gray, and another with " rich colors."

2. *A tone of medium pitch.* There is no uniformity of color here, but a generally uniform medium brightness in 26 cases. The remaining 24 discover no such association.

3. *A high tone.* This is associated in all but 14 cases with bright colors or light grays. There is a wide variety of color associations.

4. *The key of C.* Twenty persons report a color or brightness associated with this key, eight of these associating it with blue. The dominant association, however, seems to be with medium brightness, which may be attributed to the commonness of this key in music and the medium range of compositions.

5. *The key of A.* Only nine persons mention color assocations with this key, and these vary from blue to yellow.

6. *Key of D minor.* Fifteen persons associate this key with dull or soft colors, as pale green, lavender, or violet, and with grays.

7. *Key of A flat.* Only ten report visual associations and these show no uniformity.

8. *The piano.* Twenty-four persons associate the piano with colors or brightnesses, but there is no observable uniformity. The piano may perhaps represent a great variety of imagery according to key, pitch, etc.

9. *The violin.* Only fifteen have no color or brightness imagery associated with the violin. To nearly all the remaining 35 it suggests delicate colors, predominantly blue, violet, and related colors. In one case there was a traceable association between brightness or delicate color and the light dresses of violinists heard at Chautauqua.

10. *The pipe organ.* Nineteen have no color or brightness association with the organ. Most of the remainder associate it with dark values, brown being the one most frequently mentioned.

11. *The clarinet* suggests to 19 persons colors of high brightness value, but has no such association for the remaining 31.

12. *The trombone.* Fourteen reports associate this instrument with dark colors or yellow, with brown predominant.

13. *The cello.* In 19 reports the browns and reds predominate, perhaps due, in some degree, to association with the color of the instruement.

14. *The snare drum.* Twenty persons report an imagery usually of bright colors or gray. In four cases there is a mixture of colors or brightnesses.

15. *The bass drum.* Twenty-eight persons report an imagery chiefly of low brightness values.

16. *The flute.* To twenty-four persons the flute suggests colors of high brightness values, or white.

17. *Dvorak's Humoreske.* A large proportion of the students have color association with this familiar composition, but there is no uniformity. Some appear to distinguish different color or brightness imagery corresponding to the very distinct moods of the piece.

18. *Mendelssohn's Spring Song* is rather naturally associated with spring colors, greens, pinks, etc., in 33 cases.

19. *Chopin's Funeral March* is associated by 32 persons with dark shades and such colors as blue, violet, and lavender. The use of lavender, as well as black and grey, in funeral decoration should be noted.

20. *The Star Spangled Banner* could with difficulty be dissociated from the colors of the flag itself. However, 26 persons associate it with single colors, chiefly red and yellow.

21. *Annie Laurie* suggests to 27 people soft and relatively dull colors, 17 of them mentioning blue or green.

22. *The Soldiers' Chorus from Faust* is associated in the experience of 22 persons with bright colors, red and blue being predominant.

23. *The Pilgrims' Chorus from Tannhauser* suggests medium or dark colors or brightnesses to 17 people.

24. *A lively march* suggests red to 19 persons and other colors to 10 more.

25. *A dreamy waltz* has color or brightness associations for 29 persons, chiefly the softer colors of relatively high brightness, as light blue, pale yellow, pale pink.

It is clear that much, perhaps most, of the visual imagery aroused by musical selections or even by given musical instruments is derived from particular experiences and associated circumstances. Such imagery is apt to be very complicated and shifting, and hence anything like Scriabin's "colored symphony" involves immense, perhaps insuperable, difficulties.

There are, however, certain observable tendencies to uniformity, whatever their origin may have been. A high tone or a high pitched instrument is generally associated with bright colors or lighter grays, while a low tone or a commonly low pitched instrument suggests dark color and brightness values. There appears also to be a relation between the timbre of an instrument and the richness of color associated with its tone. Although there is a wide variation of color-imagery, it is probable that the common term "tone-color" is not a mere figure of speech based upon analogy. A tone which approaches a "pure" tone is described by musicians as "white or colorless," It is probably not a mere musician's whim that commonly associates complexity of tone with the visual richness of color.

A COMPARISON OF TWO METHODS OF GIVING THE NUMBER SERIES COMPLETION TEST.

JOHN E. ANDERSON, Yale University

Incidental to an investigation upon intelligence tests with Yale Freshmen a comparison was made of the cross-out method as developed by Pressey[1] and the completion method as used in the army of giving Alpha Test 6, the number series completion test.

The cross-out test was constructed by taking Test 6 Alpha Form 9, completing each series and inserting a number not in the series in each row in such a way that at first glance it might appear part of the series. The subjects were given instructions to cross out the number in each row which did not belong in the series. The Test 6 Alpha instructions and examples were paraphrased to fit the cross-out method, being kept as nearly as possible in the original form.

A preliminary examination of 14 subjects demonstrated that the Alpha Test 6 time limit of 3 minutes was much too brief for the cross-out method and resulted in the selection of 7 minutes as the time limit.

Eighty-five subjects were used, obtained by requesting the men of three divisions of a required subject to report for a second examination which consisted of the cross-out test among several others. These men had previously taken Alpha Form 6 with the entire group of Yale College Freshmen.[2] An interval of seven months elapsed between the two examinations.

The results are as follows:

	Time Limit	Range	Mean	Standard Deviation
Completion Method.....	3 mins.	5–20	13.5	2.7
Cross-Out Method.....	7 mins.	4–20	12.7	3.4

Although the time limits differ to a considerable extent, the two methods of giving the test result in practically the same range, mean, and standard deviation.

[1] Pressey, S. L. and Pressey, L. W. *Journal of Applied Psychology*, Vol. III, 1919, p 138-150.

[2] Anderson, J. E., *School and Society*, Vol. XI, 1920, pp. 417-20.

Correlation coefficients were obtained by the product moment method between the average college standing of the men for the entire Freshman year's work and the test scores. These are as follows:

	r.	P. E.
College standing and Cross-out	+.25	±.07
College standing and Completion	+.04	±.07
Completion and Cross-out	+.44	±.06
Alpha score and College Standing	+.25	±.07
Alpha score (with cross-out scores substituted for completion scores) and College Standing	+.34	±.06

Unfortunately I have no measure of the reliability of either of the methods because the tests were not repeated. But the coefficient of correlation between the completion method and the cross-out method of giving the test is low enough to indicate that the change in the method of administration results in a distinct test, different from the original, a conclusion borne out by the other coefficients. While the cross-out method correlates to some extent with college standing the completion method does not. The effect of substituting cross-out scores for completion scores in Alpha is shown by the increase in the resultant coefficient for total score with college standing from .25 to .34.

The evidence from 85 cases of Yale Freshmen is that the cross-out method of giving the number series completion test is superior to the regular completion method as measured by the criterion of correlation with college standing.

THE APPLIED PSYCHOLOGY OF NAMES

By A. A. Roback, Harvard University,
Assisted by Marie Groetzinger

1. *Nature of the Problem*

Though the field of memory has been traversed carefully by so many painstaking investigators since the days of Ebbinghaus, new problems have come up through channels which until recently had not been amenable to the scrutiny of general psychology. The practical demands of applied psychology opened the way for many a new problem; and as is frequently the case, the results gained in the practical sphere may offer some suggestions as regards the theoretical aspects of memory.

In our present commercial system, it is becoming increasingly common to see firms consisting of two or more partners, which often necessitates their names being arranged in a certain combination. Usually what determines the precedence of one name over another is the seniority of one of the partners. But it is not always that a firm can claim a senior partner. Suppose two men agreed to enter into a business relationship with the same capital and with equal privileges and liabilities. The question before us then is: is there any general rule that can be applied as to the way the combination of their names should appear in advertisements, on letter-heads or in any form of publicity? If Smith and Stanft were to start business together, would it be more advantageous to have the names stand as they were just mentioned, or would it be more advisable to reverse the order and call the firm Stanft and Smith? It will readily be perceived that the issue is one between familiarity and unfamiliarity, since in most situations of that sort, one name is not so familiar as the other. There are, to be sure, other differences between names, but that of familiarity or unfamiliarity seems to be the most comprehensive, embracing even the length element of the name. We often hear people say " Oh, I can't think of the name. It's such an *uncommon* name." The memory lapse is thus directly ascribed to unfamiliarity.

Were it merely a matter of settling the question whether familiar names are more easily remembered than unfamiliar ones, experiments would scarely be neccessary. The princi-

ple of association implies this result unmistakably, and in practically every memory investigation there are indications of the greater mnemonic value in the case of the more familiar material.[1]

In confining our problem to the study of combinations consisting of familiar and unfamiliar names, we have a definite task to perform, since no information is as yet available on this phase of memory, and in default of such knowledge, business men who are confronted with the situation referred to above, will decide the question *a priori* or perhaps by tossing a coin—methods which are not permissible in either science or business.

In the course of the investigation, a new item presented itself for further inquiry, viz, the fact that repetition offers a greater gain in effective value for unfamiliar names than it does for familiar ones. This apparent result prompted another set of experiments in order to ascertain whether the gain is substantial enough to make up for mnemonic difficulty going with unfamiliarity. For theoretical purposes, the bare result would be important in itself, but the practical side of the problem thus becomes encumbered by another situational factor, so that if it is established that the one type of combination has an advantage over the other, the question may be asked: after how many exposures? It may be that after the first repetition, the name "Cui" has a better chance for reproduction than such a common name as Smith or Jones but that subsequently, either on account of the many associative inhibitions occurring with the latter or else because of the disproportionate distribution of attention, the name "Cui" would actually be the one to be recalled more easily in connection with a given firm.[2]

That the applied psychology of names is no minor factor in business can be inferred from the fact that so many aliens and Americans of foreign descent find it expedient either to change

[1] It must be noted that a common name and a familiar name are not interchangeable terms. An uncommon name may become familiar through some political event or because of the rise to popularity of some theatre (movie) star. Such accidents will of course, to a considerable extent, affect the degree of familiarity or unfamiliarity of a name without appreciably reducing its uncommonness. Contingencies of this sort cannot enter into our problem, though they doubtlessly have a decided bearing on our memory function.

[2] The repression of certain names on Freudian principles, if at all operative, is altogether too individual an occurrence to render it worthy of consideration in this connection. Should we accept the extreme view that every memory lapse is symptomatic of a repression, the whole of the psychology of memory would reduce to a speculative psychoanalysis barren of the least predictability.

their names entirely or else modify them in some way as to conform to the general vogue of names: the "owitz" or "sky" termination in Slavic names is frequently dropped; the *Umlaut* and duplication of letters so common in German names are often done away with, and in general there is a tendency to adapt the name to suit the native taste. Most foreigners who enter an application for such changes state explicitly that it is a business measure; and they seem to be satisfied with the results.

The subject is not devoid of its ethical and legal aspects. It may be questioned whether one with a true sense of family pride would assume another name. Still more may it be disputed whether it is commendable to give up from practical motives the most conspicuous ancestral heritage. When we note the persistent adherence of the Savages, the Cowards, the Hoggs, the Butchers, the Swindles and the Coffins to their ill-sounding, but at the same time significant, patronymics, we cannot but admire their loyalty to their predecessors as well as their independence in maintaining their familial identity unbroken.

Happily our investigation is not concerned with moral issues nor is it called upon to consider personal whims or tastes or the domineering influence of one partner over the other in the matter of name combinations. We shall assume, on our side, that the only factor which is to determine the arrangement of the parnters' names is to be that of promoting their several business interests; and within that compass, our problems lends itself to a clear-cut treatment.

The practice of adopting impersonal trade names, such as is a necessity with corporations, will at once suggest itself as a welcome compromise whenever there is a question that is likely to become serious as to the priority of a particular name. There are indeed numerous lines of business which favor the impersonal trade name. A garage, for obvious reasons, will almost invariably be known by its locality. Similarly we are accustomed to such signs as The City Coal Co., The National Tea Co., The United States Tire Co., The New York Paper Co., The College Bindery, etc. etc. Manufacturers of novelties and even standard articles are especially apt to link their wares in the minds of the public with an impersonal symbol suggestive of (in many cases inappropriate to) the particular article. The marketable value of this symbol as a brand or trademark or label has been so much emphasized in books on advertising that the mere mention of it here as bearing a tangential relation to our problem is sufficient.

It will readily be conceded that the personal name is still in vogue among most firms and particularly in certain lines of merchandise, where the adoption of a patented trademark does not prevent the merchants from identifying themselves in connection with the wares.

2, *Method of Procedure*

The experiments to be reported were carried on in the Psychological Laboratory of the University of Pittsburgh during both semesters of 1917-18. The subjects were two instructors in the department of psychology, and one woman student, with considerable training in psychology.

Apparatus. The apparatus consisted of a kymograph and two screens. The larger screen was made of black card board with an opening $3\frac{1}{2} \times 2$ inches. The smaller screen was made of tin, painted black, and curved to fit the kymograph drum. The opening in the second screen ($2\frac{1}{2} \times \frac{1}{4}$ inches,) was large enough to expose one stimulus at a time from the list revolving on the kymograph drum.

Material. Familiar and unfamiliar names were used in single columns and in combinations of (a) familiar with unfamiliar, and (b) unfamiliar with familiar. The names were arranged and grouped as follows:

1.	20	Monosyllabic	familiar
	20	monosyllabic	unfamiliar
2.	20	dissyllabic	familiar
	20	dissyllabic	unfamiliar
3.	15	monosyllabic	familiar with unfamiliar
	15	monosyllabic	unfamiliar with familiar
4.	15	dissyllabic	familiar with unfamiliar
	15	dissyllabic	unfamiliar with familiar
5.	10	trisyllabic	familiar with unfamiliar
	10	trisyllabic	unfamiliar with familiar

Examples of familiar names—Brown, Dixon, Foster, Wallace, Matthews, etc.

Examples of unfamiliar—Farquhar, Martinez, Swoboda, Enza, etc.

Six, or eight lists of names were given at each sitting, the number varying on account of the difference in the length and the complexity of the lists.

At each sitting the lists of the single names were given first, followed by the lists of combination, i. e. beginning with

the simpler names and then going to the more complex combination. The subject read aloud each stimulus as he saw it. When the list was complete he would write down as many of the combinations and single components of the combinations as he could remember.

During the first semester one review of the list was given, but during the second semester two reviews were given of each list so as to test whether there was any tendency to remember the unfamiliar names better after repetition than the familiar names. In this way the subject at each sitting got some lists that were entirely new while others he merely had to review.

It was rather difficult to get names that all the subjects would regard as either decidedly familiar or unfamiliar. The aim of the experimenter was of course to eliminate all indefinite cases, though this was not possible at all times. Local differences naturally cannot but enter into the determination of the degree of familiarity. Thus a name like Shanahan would be considered familiar in Pittsburgh though elsewhere it might not be so regarded.

It took fifty seconds to expose a list of single names and one minute to expose a list of paired names. All of the names were typewritten on long sheets of paper so as to fit around the kymograph drum.

One of the subjects required a double exposure of each list in order to reproduce at least several of the names.

The first day the series of single familiar names was exposed before the unfamiliar names. The same procedure was gone through with the names in combination—the familiar-unfamiliar combination being given before the unfamiliar-familiar. At the second sitting, however, this order was reversed and the unfamiliar names were exposed first. This alternating method was used throughout the experiment in order to eliminate the well known factor of *primacy*, according to which the first elements are remembered better than the succeeding ones.

Key to Tables

The tables for the monosyllabic, dissyllabic and trisyllabic combinations give in separate columns the total percentage both for the combination as well as for the separate single components i. e. either the familiar or the unfamiliar element remembered.

After repetition there is always a gain as may easily be expected, but in one or two cases, curiously enough, a loss is

shown, in which case the numbers are preceded by a minus sign.

There were no third trials given during the first semester, which explains why the results for the first and second trials are based on so many more combinations than the results for the third trials.

During the first semester two weeks intervened between successive trials, but during the second semester the interval was reduced to one week.

TABLE No. 1

Total percent. of names remembered out of 360 single monosyllabic and 120 single dissyllabic names.

	No. of Stimuli	First Trial		Second Trial	
		Familiar	Unfamiliar	Familiar	Unfamiliar
Total percent. of names remembered from the monosyllabic single series.....	360	51%	35%	54%	41%
Total percent. for the dissyllabic single series.....	120	42%	24%	42%	26%
Total percent. for the monosyllabic and dissyllabic single series.....	480	46.5%	29.5%	48%	33.5%

Note on Table 1.

This table shows the total percent. remembered out of 360 single monosyllabic and 120 dissyllabic names. As would be expected, during the first trial there were more familiar names remembered than unfamiliar; and in the second trial there was the natural increase in every case except the dissyllabic familiar, due perhaps to distraction on the part of one of the subjects in this particular trial. These results also reveal the fact that the unfamiliar names show a greater percentile gain in the second trial over the first than do the familiar ones. In the monosyllabic names there was a gain of 6% in the unfamiliar while in the familiar series there was a gain of only 3%. Furthermore, the gain for the unfamiliar dissyllabic names was 2% while the familiar dissyllabic names showed no gain. This general tendency appears likewise in the total percentage of the combined monosyllabic and dissyllabic lists.

TABLE No. 2

Total percent. of names remembered out of 90 *monosyllabic* names in combination.

		First Trial						Second Trial					
		Familiar—Unfamiliar			Unfamiliar—Familiar			Familiar—Unfamiliar			Unfamiliar—Familiar		
	No. of Stimuli	C	F	U	C	F	U	C	F	U	C	F	U
Total percent. for Monosyllabic Combination.....	90	22%	4.4%	8%	21%	9%	4.4%	30%	5.5%	16%	22%	10%	5.5%
Gain of second trial over first trial.....								8%	1.1%	2%	1%	1%	1.1%

Note on Table 2

This table gives the total percent of names remembered in *combinations* of monosyllabic familiar and unfamiliar names such as Smith and Knaus, Tsolt and Hughes. The gain of the second trial over the first in these combinations is also given.

In both the first and second trials there were more familiar-unfamiliar combinations remembered than unfamiliar-familiar ones. As is shown in the gain of the second trial over the first, the unfamiliar half of the combination benefits more by the repetition than the familiar half.

TABLE No. 3

Total percent. of names remembered after the first and second trials of the combination of 540 disyllabic names.

	First Trial						
	No. of Stimuli	Familiar-Unfamiliar			Unfamiliar-Familiar		
		C	F	U	C	F	U
Total % for disyllabic combination.....	540	17.3%	10.4%	4.4%	14.9%	14.7%	4.9%
Gain or loss of second trial over first trial.....							

TABLE No. 3—*Continued*

		Second Trial					
	No. of Stimuli	Familiar-Unfamiliar			Unfamiliar-Familiar		
		C	F	U	C	F	U
Total % for dissyllabic combination.	540	10.4%	8.9%	10.7%	17.1%	15.3%	7.8%
Gain or loss of second trial over first trial.....		6.9%	1.5%	6.3%	2.2%	.6%	2.9%

Note on Table 3.

This table gives the total percent. of names remembered after the first and second trials of the dissyllabic combinations of 540 names, and also the gain or loss in the second trial over the first. There was a gain in every case, which naturally was to be expected, except in the case of the whole combination in the familiar-unfamiliar list which shows a loss of 6.9%. This loss however, is to be considered together with the gain in the familiar and unfamiliar separate names which formed part of the combination, so that in reality the loss was much slighter; and if we give unit values to the combination and half values to each separate component (of the combination) then the loss for that series would be only 3%. This loss, which seems peculiar, may be explained by the physical condition of one subject—at least there is a note to that effect in the protocol.

In the first trial there is a greater percent. of names remembered in the familiar-unfamiliar combination than in the unfamiliar-familiar. However, this is reversed in the second trial where there were 17.3% remembered in the unfamiliar-familiar combination over against only 10.4% in the familiar-unfamiliar combination. This result is not incompatible with the first result, i. e. that the familiar-unfamiliar combination is more favorable for remembering than the unfamiliar-familiar, but is rather in accord with what has afterwards been found to be the case in regard to the effect of repetition on the familiar names as compared with the unfamiliar names.

This table also shows a greater gain in the second trial of the unfamiliar over the familiar, since in both types of combinations (the familiar-unfamiliar and the unfamiliar-familiar) the unfamiliar components showed in the second trial a much

greater gain than the familiar components, viz. 6.3% and 2.9% as against 1.5% and .6%.

TABLE No. 4

Total percent. of names remembered after the first and second trials of the combinations of 60 *trisyllabic* names.

First Trial

	No. of Stimuli	Familiar-Unfamiliar			Unfamiliar-Familiar		
		C	F	U	C	F	U
Total percent. for the trisyllabic Combinations.	60	11.6%	20%	10%	20%	13.3%	15%
Total percent. for the trisyllabic Combinations Gain of second trial over first, using only two subjects.....	40	10%	25%	5%	12.5%	20%	15%

Second Trial

	No. of Stimuli	Familiar-Unfamiliar			Unfamiliar-Familiar		
		C	F	U	C	F	U
Total percent. for the trisyllabic combinations.....	60	25%	13.3%	11.6%	21.6%	23.3%	15%
Gain of second trial over first trial.....		13.4%	-6.8%	1.6%	1.6%	10%	0
Total percent. for the trisyllabic combinations of two subjects.....	40	20%	20%	7.5%	20%	30%	12%
Gain of second trial over first, using only two subjects..		10%	-.5%	2.5%	7.5%	10%	-.3%

Note on Table 4.

This table giving the total percent. of names remembered out of a series of 60 trisyllabic names in combination such as Richardson and Boyarjan was inserted only for the sake of completeness. As a matter of fact its value may be questioned not only because the number of stimuli was insufficient to warrant any conclusion but also for the reason that some

of these names which were thought to be unfamiliar by the experimenter were really familiar to one of the subjects. This is the only series in which there is no correlation apparent between the arrangement of the combination and its memory value, even after eliminating the results of the one subject whose acquaintance with a certain class of names proved to be a disturbing factor.

TABLE No. 5

Total percent. of names remembered after the *third trial* of the combination of 180 dissyllabic names.

	No. of Stimuli	Familiar-Unfamiliar			Unfamiliar-Familiar		
		C	F	U	C	F	U
Total percent. for the third trial dissyllabic combinations.	180	21.6%	8.3%	11.1%	18.7%	17.2%	13.8%
Gain or loss of of third trial over first trial..	180	3.3%	—2.1%	6.7%	3.8%	2.5%	8.9%
Gain or loss of third trial over second.....	180	10.2%	— .6%	.4%	8.3%	1.9%	6%

Note on Table 5.

This table gives the total percent. for the third trial of the dissyllabic combination of 180 names and also the gain or loss over the first and second trials.

These results show the natural increase over the first and second trials. The only place showing a loss is in the familiar column of the familiar-unfamiliar combination. This loss however, is very slight and is made up for by the gain in the other columns. Giving unit values to the complete combination and half values to the separate components, there is a total gain of 10.1%.

In every case the unfamiliar names show a greater gain upon repetition than the familiar ones.

Note on Table 6.

This table gives the total percent. of names remembered after the third trial of the trisyllabic combinations of 60 names, and also the gain or loss of the third trial over the first and second trials. The results are the same as in table 5

TABLE No. 6

Total percent. of names remembered after the *third trial* of the combination of 60 trisyllabic names.

		Familiar–Unfamiliar			Unfamiliar–Familiar		
	No. of Stimuli	C	F	U	C	F	U
Total percent. for third trial of trisyllabic combinations	60	31.6%	15%	21.6%	25%	21.6%	28.3%
Gain or loss of third trial over first	60	20%	—5%	11.6%	5%	8.3%	13.3%
Gain or loss of third trial over second	60	6.6%	1.7%	5%	4.4%	—1.7%	13.3%

in that the familiar-unfamiliar combination is favored to begin with, but after repetition, the unfamiliar components of both the familiar-unfamiliar and unfamiliar-familiar combinations show a greater mnemonic gain than the familiar components.

Note on Table 7.

This table gives the total percent. for all the series of combined names, thus showing the relation between the familiar-unfamiliar and unfamiliar-familiar combinations. The third trial concerns only the combination of 180 dissyllabic names and 60 trisyllabic names, since no third trials were given for the monosyllabic combinations. In the first and second trials

TABLE No. 7

Total percent. of names remembered for *all the series* of combined names.

First Trial

	No. of Stimuli	Familiar–Unfamiliar			Unfamiliar–Familiar		
		C	F	U	C	F	U
Total percent. for all series of combinations	690	16.9%	11.6%	7.5%	18.9%	12.3%	8.1%
Total percent. counting combinations as 1, and single components as ½	690	26.4%			29.05%		

TABLE No. 7—*Continued*

Second Trial

	No. of Stimuli	Familiar–Unfamiliar			Unfamiliar–Familiar		
		C	F	U	C	F	U
Total percent. for all series of combinations.....	690	21.8%	9.2%	10.4%	20.2%	16.2%	9.4%
Total percent. counting combinations as 1, and single components as ½..	690	31.7%			33%		

Third Trial

	No. of Stimuli	Familiar–Unfamiliar			Unfamiliar–Familiar		
		C	F	U	C	F	U
Total percent. for all series of combinations.....	240	26.6%	11.6%	16.3%	21.8%	19.4%	21%
Total per cent. counting combinations as 1, and single components as ½.....	240	40.59%			42%		

the results are taken from 690 combinations of monosyllabic, dissyllabic, and trisyllabic names, but in the third trial the results concern only the combination of 240 dissyllabic and trisyllabic names. These results might seem to reveal a slight preference for the familiar-unfamiliar combination over the unfamiliar-familiar. However, by giving unit values to the whole combination and half values to each of the familiar and unfamiliar components, it becomes evident that the unfamiliar-familiar combination is favored, due to the greater number of single unfamiliar components remembered as compared with the single familiar components.

TABLE No. 8

Total *gain or loss* for all the series of combined names.

	Familiar–Unfamiliar			Unfamiliar–Familiar		
	C	F	U	C	F	U
Total gain or loss of second trial of combination series over first trial	4.9%	—2.4%	3.2%	1.3%	3.9%	1.3%
Total gain of third trial of combination series over first trial	9.7%	.05%	8.85%	2.95%	7.1%	12.95%
Total gain of third trial of combination over second trial	4.8%	2.45%	5.65%	1.65%	3.2%	10.65%

Note on Table 8.

This table shows the relation between the gain or loss of the second trial over the first, the third trial over the first trial and the third trial over the second; and the relation between the gain in the unfamiliar as over against the familiar. In every case the gain after repetition is greater in the unfamiliar than in the familiar column.

Conclusion

The above results tend to prove (1) that a combination of names possesses a greater immediate memory value if the more familiar component of the combination appears last, and the less familiar first; (2) Other things equal, the unfamiliar element shows a greater memory gain than the familiar component—which sugests that in time, that is to say, after a large number of repetitions, the former will become a more effective stimulus than the latter.

INTELLIGENCE TESTS AND ACADEMIC STANDING

EDNA GORDON and H. J. BAKER, University of Michigan
Communicated by W. B. PILLSBURY, Professor of Psychology, University of Michigan

According to the survey made by Miss Caldwell[1] there is not much evidence for a close correlation between the results of mental tests and college grades, the range in coefficients of correlation between these two factors, including Miss Caldwell's own experiment is from .09 to .44.

The following report adds no conclusive evidence to that already obtained by others, but the results given here correspond somewhat to those obtained by Miss Caldwell.

As a part of the course in the study of mental tests, forty-four students in an elementary course in Psychology were given the Stanford Revision of the Binet-Intelligence Tests XIV, XVI (Average Adult), XVIII (Superior Adult).

The majority of the students were sophomores, the remainder upperclassmen in the University. The average chronological age was twenty-one years, three months; mental age, approximately seventeen years, ten months. The range in intelligent quotients was 91 to 119, average 111.

The grades of these students in the various subjects pursued were obtained from the Registrar's office. Using the ratio of hours to honor points, (a C grade in a four-hour course gives four points, B grade, eight points, A grade, twelve points, D grade no points) a general ratio was obtained for each student in all subjects, and in each group of subjects as follows: Languages, Rhetoric and English, History, Philosophy, Political Science, Political Economy and Sociology, Oratory and Fine Arts, Mathematics, Physics and Chemistry, Other Sciences.

The coefficient of correlation, Pearson formula, was obtained between the I.Q. and the general ratio (hour-honor

[1] Helen Hubbert Caldwell, "Adult Tests of Stanford Revision Applied to College Students." *Jour. Educational Psychology*, Dec. 1919.

points) for the group in all subjects; and for each group of subjects as shown in the following table:

I. Q. Correlated With		Probable Error
General Ratio	.446	Less than r/5
Political Ec.—Soc	.548	" " r/5
Other Sciences	.537	" " r/5
Rhetoric—English	.481	" " r/5
Mathematics	.450	" " r/4
Oratory—Fine Arts	.354	" " r/2
Physics—Chemistry	.334	" " r/3
Languages	.229	" " r/3
Philosophy	.096	Greater than r
History	.047	" "
Political Science	.017	" "

It will be noted that the probable error is so large in the last three cases that no significance can be attached to the results; in fact, in all the coefficients of correlation given in the above table, it must be borne in mind that the number of students and the number of hours represented in the different subjects were widely variable. Therefore no attempt will be made to draw conclusions save the very general one, that on the whole there is a slight positive correlation between the results of this intelligence test and academic standings, and that further and more extended investigation is needed before one can definitely state what the relationship is between these two factors.

In addition to the college students, twenty-four students in a short term course in Public Health Nursing were given tests. The coefficient of correlation between the intelligence quotients and the grades in psychology is .50. The following summer a second group of twelve nurses were tested by another class and a coefficient of correlation of .21 obtained between intelligence quotients and grades in psychology. A third group of eighteen nurses were tested during the first semester of this year, and a coefficient of correlation of — .187 was obtained. Owing to some difficulty and misunderstanding in the administrative offices, we were unable to obtain the records of the nurses in other courses.

The last two correlations we consider of little value, because of the small number of cases, and although the first coefficient, .50, does seem significant, we cannot place as much confidence in the results of the tests given the nurses as in the results obtained from testing the regular students. In first place, the nurses were of widely varying education and

experience, some being middle aged, with no high-school training; others were high-school graduates and had but recently finished their nurse's training. The regular college students, on the other hand, were practically of the same age and experience. (Then too, the inexperience of the examiners may account in some measure for the apparent discrepancy in results.) The college students were all tested by three persons who had previous experience in giving tests.

A DECISION STUDY OF 150 YOUNG MEN AND WOMEN

By Sybil Marsh Gibson

1. *Description of the Test*

The following study was undertaken in the Harvard Psychological Laboratory in 1915 with the purpose of standardizing a decision test for use with psychopathic and defective cases. In the search for norms with which to compare the performances of such cases, comparative data from normal individuals, men and women, were obtained, and these are presented here as having interest in themselves.

The aim was to have a series of decisions of graded difficulty and of uniform difficulty within a given grade so that some idea might be obtained of the characteristic time reaction of the individual to decision situations of a given difficulty, to such situations as compared with situations of less and greater difficulty, the constancy of such time reactions, and the correctness of the resulting decisions.

Professor Muensterberg's so-called judgment test[1] was chosen for a starting point. The test from which the present data were obtained is, however, much changed from the Muensterberg test. The object of the changes has been to make the test more adapted for bringing out the decision reactions mentioned above.

The capital letters E, I, Y, and K were selected after experimentation as having more uniform appeal to attention than the Muensterberg letters, A, E, O, and U, and unlike the Muensterberg test, no additional letters were used. These four letters are arranged in five rows of ten letters each on twenty-four cards three and a half inches long by two and three-fourths inches wide, the letters occupying a block at the top of the card. Only four arrangements of letters were used throughout the series of twenty-four cards, giving four situations of graded difficulty as follows: grade I, the most easy of

[1] Hugo Muensterberg, *Psychology and Industrial Efficiency* pp. 83-96, and J. W. Bridges, *Psychological Review Monographs*, Aug. 1914, pp. 51-55.

decision, in which, the predominating letter appeared twenty-six times, and the three non-predominating letters eight times each; grade II, in which the predominating letter appeared twenty-three times, and the non-predominating letters nine times each; grade III with the predominating letter twenty times, and the non-predominating ten times each; and grade IV, the most difficult, in which the predominating letter appeared seventeen times and the non-predominating eleven times each. These four arrangements of letters were selected after experimentation, a general mixing of the letters being sought instead of "catchy" arrangements in which the predominating letters were arranged on the edge of the field, etc., that the basis for difficulty might be numerical so far as possible. The aim in the selection of total number of letters, number per line, number of lines and arrangement within the lines was to obtain four grades of difficulty which would, on the average, take for decision times from two seconds for the easiest grade to ten or fifteen seconds for the most difficult. The averages of the groups included in this study approximate these figures.

Four cards make up grade I and IV respectively, and eight cards grades II and III respectively, different predominating letters, merely, being substituted in the four arrangements. While it was desired that all cards within a given grade should be identical with the exception of the different predominating letter, this is obviously impossible, since, for example, on a K card we might have a K between an I and an E, but on an E card we cannot have an E between and I and an E, but must substitute some other non-predominating letter for the second E. All that was possible was to have the predominating letters occupy the same spatial position on the cards, with definite spatial relations to non-predominating letters, though not always to the same non-predominating letters.

Since there are eight cards in both grades II and III, it is obvious that not only does the same arrangement appear eight times in each of these grades, but that in four cases in each, the identical card appears twice. Preliminary experimentation and experience with the test both give little ground for objection to this on the score of greater facility in decision on repeated arrangements, or repeated cards. Apparently a card of the same arrangement appears very different when a different predominating letter is substituted, and the appearance of any given card is quickly forgotten after a new card has been presented. Sometimes even two cards exactly alike can be presented to a normal subject in sequence without his

noticing that they are identical. However, this extreme situation never occurs in the present test.

The manner of giving the present test is also very different from that of the original Muensterberg test. The cards are given in a definite sequence to each subject so that, unlike the Muensterberg test in which the cards were shuffled before beginning, each subject takes exactly the same test. This manner of giving the cards likewise allows the timing of decisions on separate cards. The principle in devising the sequence in which the cards should be given was to have no very difficult cards at the beginning before the subject was accustomed to the test or to discourage him at the task before him, no very difficult cards at the very end when there might be some measure of fatigue, no identical cards in succession, and no two difficult cards in succession.

The directions given the subject before he undertook the test, unlike the Muensterberg test, emphasized accuracy and not speed. It was desired to reproduce, as nearly as possible. the condition of decisions of real life, of which quick decisions form merely one group. There is to be sure always some time element in actual decisions, and a suggestion of this was brought into the directions by telling the subject that while he was not limited as to time, his time was being recorded for every card.

The decision and time of decision on each card was then recorded by the examiner. The time was recorded merely in seconds by an ordinary second hand. Exact laboratory methods were not desired for a test that was planned for free use outside the laboratory in connection with routine scales. However, since separate cards are timed and time decision on grade I was often one or two seconds, it is felt that the method is not fine enough, and that a stop watch should have been used to measure fractions of a second. However, though the rougher method was used in obtaining the data presented here, the differences in the individual records and between the two groups are so striking as not to be attributable to the roughness of the method, and so seem to be of value in spite of it. Accuracy records are, of course, not affected by this. The lack of introspective data from the subjects is also to be regretted.

In evaluating the individual records, the following measures were used: total time taken for the test, average time spent on a card of each grade, porportional variation of the decision times of the individual on each grade $\left(\frac{\text{M. V.}}{\text{Mean}}\right)$, accuracy on

each grade, and the six ratios between the average four grade times to show how much time the individual spent on harder decisions as compared with easier ones. The use of the measure of proportional variability involved much labor which seemed out of proportion to the results obtained from it. While some such measure was needed to show how constantly an individual spent a given amount of time on problems of the same degree of difficulty, only large variations seem to be very important since all of the normal individuals showed considerable variability, and such high variability can be fairly easily discovered on glancing through the record. The measures of total time, average grade times and grade accuracy are, of course, essential and easily obtainable. The use of the six ratios is less readily obtained and makes the test less easy to evaluate. In comparing a single record with the norm for the group, the six ratios can be fairly accurately estimated at a glance, the detailed figuring being necessary only in comparing groups.

2. *Comparison of Men and Women.*

The test was given to 150 men and women, college students. They were, for the most part, undergraduates, with a few graduate students. They were not chosen for any special qualities or abilities, but constituted a general mixed group which volunteered for the test. The average age of the two groups was practically the same, that of the 75 men being 20.24 years, and that of the 75 women 20.99. The groups were also both fairly homogeneous in age, the mean variation from the average ages of the group being .99 of a year with the men, and .77 of a year with the women.

Both groups were being tested at the same time, and by the same examiner. The examining was done before the make-up of the classes was changed by the war.

Comparing the performances of the two groups for decision time, we find that on each grade each group took more time on the average than on the preceding grade. Each group, then, spent on the average more time for decision on harder situations than on the easier ones. The average times for the two groups were as follows:

	Total Time	Grade I	Grade II	Grade III	Grade IV
Men.....	2′ 57″	2.76″	3.99″	6.10″	9.10″
Women.....	2′ 8″	3.59″	5.05″	8.18″	14.34″

It is also evident from these figures that the women took more time, on the average, on each grade than the men, with the

difference slightly more marked on the more difficult grades, the relation of women's time to men's time being as follows:

Grade I	1.30 : 1
Grade II	1.26 : 1
Grade III	1.34 : 1
Grade IV	1.54 : 1

The limits of variation with both groups were wider on each succeeding grade, with the reaction times of both groups least homogeneous on grade IV. The women group showed wider limits of variation on each grade than the men group.

Comparing the two groups for accuracy, the women had fewer mistakes on all four grades than the men.

On grade I, only one mistake occurred among the women, and seven among the men, an average of .013 and .09 respectively. The seven mistakes of the men were distributed among five individuals, three making one mistake apiece, and two men two each.

On grade II the men made thirty-two mistakes and the women sixteen, an average of .43 and .21 respectively. The sixteen mistakes of the women were distributed among thirteen individuals, ten making one mistake apiece and three making two apiece. The thirty-two mistakes of the men were distributed among fifteen individuals, six making one mistake apiece, three making two apiece, five making three apiece, and one making five. There were then approximately the same number of individuals in each group making mistakes in the grade, but there were more individuals among the men making more than one mistake apiece.

On grade III, the men had ninety-nine mistakes, and the women eighty-three, an average of 1.32 and 1.10 respectively. The eighty-three mistakes of the women were distributed among forty-two individuals, seventeen having one apiece, twelve two apiece, seven three apiece, four four apiece and one having five. The ninety-nine mistakes of the men were distributed among fifty-four individuals, twenty-five having one apiece, seventeen two apiece, eight three apiece, and four four apiece. On this grade, then, there were more individuals making mistakes among the men than among the women, but not more men making a large number of mistakes.

On grade IV, the men made one hundred and sixty-four mistakes, and the women one hundred and thirty-five, an average of 2.18 and 1.77 respectively. The mistakes were distributed through practically the entire groups (seventy-two men and seventy-one women) as follows:

	Women	Men
1 mistake	26	17
2 "	27	26
3 "	17	21
4 " (all)	1	8

More men than women, then, made three or four mistakes and fewer only one or two mistakes.

While the women, then, were more accurate than the men on all grades, this difference is more marked on the two easier grades.

In order to compare the accuracy per individual for the whole test among the two groups, a kind of arbitrary point scaling was adopted. A mistake in grade IV was counted one, in grade III two, in grade II three, and in grade I four, on the principle that mistakes in grade IV, the most difficult grade, were more to be expected than on grade I, etc. A low score, then, means good accuracy.

RECORDS FOR MISTAKES BY POINT SCALING

Points	Men	Women
0	2	5
1	6	13
2	8	10
3	10	10
4	6	7
5	10	8
6	11	2
7	3	1
8	2	4
9	2	2
10	3	6
11	1	3
12	1	2
13	2	0
14	2	0

The average score for the women by this method of point scaling was 4.64 and that of the men 6.48. In addition to the scores on the table, there were among the women a score of fifteen and one of sixteen, and among the men one each of 16, 17, 19, 24, 27, 29. Excluding these exceptional cases, we still have a lower average among the women, though the difference is not so marked. The average score for the women would then be 4.34, and for the men 5.13. These results imply that there were a larger number of men than women who made exceptionally bad records for accuracy, but that even with the exception of such cases, the average accuracy among the women was higher than among the men. This will be considered later under grouping of individuals.

Comparing the two groups for perfect or very good accuracy records, we find two men and four women with perfect accuracy records, five men and twelve women whose only mistake was a single one in the most difficult grade, six men and ten women whose only mistakes were in the most difficult grade, one man and no women whose only mistake was one in grade III and six men and five women whose only mistakes were in grades III and IV. There were then more very high accuracy records among the women.

A comparison of the two groups for ratios of times spent on more difficult grades as compared with more easy ones shows that both groups spent more time on the average on a more difficult grade as compared with an easier one. All of the ratios, except the ratio 2/1 (that is, of grade II as compared with grade I) were larger with the women than with the men. The differences were not marked, however, except in the ratios involving grade IV for which the women showed much larger ratios. The six ratios for the two groups and comparison of the two groups follow. The women, then,

Ratios	2/1	3/1	4/1	4/2	4/3	3/2
Women	1.55	2.43	4.06	2.68	1.70	1.56
Men	1.60	2.39	3.54	2.22	1.49	1.51
Ratios	2/1	3/1	4/1	4/2	4/3	3/2
Relation Women to Men	1:1.03	1.01:1	1.14:1	1.20:1	1.14:1	1.03:1

while taking more time than the men apportioned their time among the grades much as did the men with the exception of grade IV in which they took much more time as compared with the easier grades than did the men. Of the nine hundred individual ratio records (four hundred and fifty for the seventy-five men and four hundred and fifty for the seventy-five women) only sixty-seven or about 7% showed no gradation (no rise in time for a more difficult grade) or inverse gradation (less time on a more difficult grade). These sixty-seven instances are divided about equally among the two groups (thirty-five for the women and thirty-two for the men) and are distributed among the same numbers—one-third—of each group (twenty-five women and twenty-six men). Relatively few cases of inverse or lacking gradation occured between grades which were not successive. The largest number of inverse or lacking gradation with the women (fourteen) occurred between the two easiest grades, ratio 2/1, and the largest number with the men on ratios 4/3 (thirteen) and 3/2 (eleven).

Comparison of the two groups for variability of decision

times within the grades shows for both groups lower variability on more difficult decisions with the exception of grade I. Since timing was only in seconds and the average time on grade I for men and women was respectively 2.76″ and 3.59″, the proportional variation in seconds on grade I is obviously not reliable. The women showed less variability in their decision times on all grades except the most difficult on which they were more variable than the men, as follows:

Proportional Variability	Grade I	Grade II	Grade III	Grade IV
Men	.370	.480	.395	.280
Women	.335	.436	.364	.307

To the end of finding correlations in the two groups of the numerous factors mentioned above, an attempt was made to separate the larger groups into smaller groups or decision types. Certain groups stand out at once as homogeneous.

Most conspicuous among the men is a very quick, ungraded (i.e. with low ratios or inverse ratios) inaccurate group. This group is also found among the women, but is not so numerous. It comprises 20% of the men and 12% of the women. While both of these groups are inaccurate, that of the men was more inaccurate than that of the women. A large percentage of the mistakes of the total group of men is due to this very quick group, all of the mistakes (seven) on grade I coming within this group. The average mistakes of this group as compared with total group of men were as follows:

	Grade I	Grade II	Grade III	Grade IV
Quick group	.46	1.53	2.26	2.46
Total group	.09	.42	1.32	2.18

They made 71% of the mistakes made by men on Grade II, whereas their number entitles them only to 20%, 34% of the mistakes on grade III and 22% of the mistakes on grade IV. The fact that this group approximates the average more closely on grade IV would seem to imply that even for fairly careful deliberation grade IV is difficult and that the difference between hasty and prolonged deliberation becomes less marked in results on this grade.

The quick women made the only mistake on grade I made by the women group, had 62% of the mistakes of the women group on grade II, 25% of the mistakes on grade III and 18% of the mistakes on grade IV, whereas their number entitles them to only 12% on each. The inaccuracy of the quick women, then, represents more of a divergence from the accuracy standard of the women group than does that of the

men, though the absolute inaccuracy of the quick men was greater than that of women. These quick, inaccurate women averaged less quick in their decision times than the quick inaccurate men.

A very few of the men, (two, and possibly a third) making quick relatively ungraded decisions were able to make high accuracy records. This condition was not found among the women.

A second type of reaction was indicated in both sex groups, a slow accurate type. This was much more numerous among the women, comprising 24% of the women and only 14% of the men. The women of the group likewise averaged slower than the men and showed more extreme examples of slow decisions than the men. These slow groups are less homogeneous than the quick groups, but agree in being more accurate than the rest of the sex groups, though the women are more accurate than the men. They also average higher ratios. They divide into three general groups, the first characterized by high gradation of the ratios involving grade IV (that is, composed of those who took an excessive amount of the time on grade IV alone), the second characterized by high proportional variations (composed of people whose excessive time was due to occasional very large decision times on individual cards and not on whole grades), and the third composed of those who took a constantly excessive amount of time on all grades and on all cards within the grades. The first group was found only among the women (seven of the eighteen cases) and was an exceedingly accurate group (only one mistake on grade IV was made by the whole group). The condition of occasional very large decision times is not confined to this slow group and will be considered separately. One of the slow men and two of the slow women owed their excessive time to very slow decisions on the easiest grade alone. This excessively cautious group was accurate like the rest of the slow cases.

Since the quick inaccurate reaction is more numerous among the men and the slow accurate among the women, the remainder of the two sex groups (comprising approximately two thirds) were compared to see if the differences in the averages of the two sex groups are due to the existence of the two groups discussed above, quick inaccurate and slow accurate. This is found not to be the case. The remaining women are still slower and more accurate (except for grade III on which the two groups have practically the same accuracy) than the remaining men, though the groups approximate one another

much more closely than do the general sex groups, as follows:

	Total Time	Grade I	Grade II	Grade III	Grade IV	Mistakes Per Individual	Grade I	Grade II	Grade III	Grade IV
2x3 Men.....	124"	2.52	3.85	5.98	8.94		0	.18	1.14	2.12
2x3 Women...	151"	3.06	4.13	6.70	11.80		0	.10	1.16	1.61

Within this two-thirds group greater time still tends to be correlated with greater accuracy with both sexes, but for any given time women tend to be more accurate than men taking the same time.

The cases showing high proportional variability were principally of two kinds: the first consisted of cases who were fairly quick and irregular in their times, and the second those whose variability was due to occasional very delayed or blocked decisions. The quick irregular group (that is, those whose times averaged a given time which none of the times clustered closely around) was larger among the men and the blocked group much larger among the women. The fairly quick irregular group tended to be less accurate than both the whole group and the two-thirds group left after eliminating the quick inaccurate and slow accurate. Blocking seemed to be a fairly constant tendency among the women and blocked times shade into non-blocked times, while with the men the blocking tendency seems less characteristic and blocked decisions are more sharply differentiated in time from non-blocked decisions. Among both sex groups, cases characterized by blocking averaged more accurate than the whole group or the two-thirds group, though the most delayed separate decisions occurring in both sex groups were more inaccurate than the other decisions. The blocked decisions of the men showed a higher percentage of inaccuracies than those of the women. More extreme cases of blocking occurred among the women.

The constant decision time cases (those with low proportional variability) divide into two definite groups, a small accurate group, and an inaccurate group characterized by low ratios. The latter is considered an undeliberative group in which there was also no particular tendency towards impulsive action.

Considering decision times on separate cards apart from the individual cases to see if quicker times than the average of the individual or slower times were more likely to lead to inaccurate results, it was found that with both sexes more wrong decisions were correlated with decisions taking more than the average time of the individual for the grade than with decisions taking less, with the exception of grade IV on which

slightly more of the mistakes were correlated with decisions taking less than the average. Both sexes had more mistakes correlated with average time decisions on grade IV than on any other grade, implying again the difficulty of grade IV. The most delayed decisions as compared with the average time of the individual had more than their quota of mistakes, as mentioned above, and the quickest fewer than their quota.

The women took a larger amount of time on the first few cards as compared with their average time than did the men. Though they thus adapted themselves less quickly to the new situation which the test implies, they adapted themselves more accurately, since they show fewer mistakes for the first few cards.

Considering the most accurate cases among the men and women, they are found to have slow time, high ratios and high porportional variations. The majority of the very inaccurate cases with both men and women belong to the very quick ungraded group, and the remainder show similar, if not such extreme, conditions—quick times and low ratios.

Of the cases showing lower gradation than the average on all ratios, a large majority with both sexes belong either to the very quick ungraded inaccurate group or to the slow, low variability, inaccurate group. Of the few cases remaining, two-thirds showed average accuracy and the other third poor accuracy.

Cases showing higher gradation than the average on all ratios were uniformly slow and accurate with both sexes.

The results then show fairly well marked decision groups, varying in their representation in the two sex groups, and some well marked decision tendencies and correlations of decision tendencies. The most marked groups are the very quick ungraded inaccurate group, most numerous among the men, and the slow graded accurate group, most numerous among the women, and the ungraded inaccurate group. Among the decision tendencies, most marked is the tendency toward frequent very delayed decision times among the women. This is an exaggeration of the general tendency toward slow decision times characteristic of most of the women group, contrasted with the tendency to very quick decisions among the men. The greater accuracy record of the women group throughout is striking. Among the correlations irrespective of the groups though compatible with the conditions found in them, are higher accuracy with slower times and higher ratios, and lower accuracy with quicker times and lower ratios.

BOOK REVIEW

HENRY C. LINK. *Employment Psychology.* The Macmillan Co., New York, 1920, p. xii +440.

A novel which attempts to tell a tale and preach a moral at the same time rarely succeeds in doing either particularly well. Any book taking major premises and attempting to draw minor premises, which shall result in true conclusions, labors under a dual handicap; its major premises are apt to be misstated, or its minor premises are liable to be only logical and not to work in practice. Just so, he who attempts to apply a science to the practice of human affairs has in advance our sympathy or our criticism (depending upon our temperaments and dispositions). If either the science or its applications are relatively new, these suspicions and sympathies are aggravated.

The applications of theoretical psychology to industrial practices are recent and its literature is correspondingly meager of quantity and on the whole bare of quality. Employment Psychology is Mr. Link's second book in this ambitious field. The book is divided into four parts: Part 1, Psychological Tests; Part 2, Trade Tests and other applications of employment psychology; Part 3, Selection and Retention, and Part 4, Conclusions.

Part 1—Psychological Tests—attempts to show the results of actual tests given to different types of workers, both in the office and in the shop, indicating the modifications that have been made to these tests to adapt them to differing circumstances. Difficulties are frankly considered and solutions of these difficulties indicated, so far as they have been discovered. The psychological background is fairly and on the whole clearly stated, and the results are tabulated with scientific impartiality. For the most part, the treatment is that of the psychological monograph but the usual heaviness of this procedure is enlivened by concrete circumstances and, for instance, by the treatment of general intelligence in a Platonic dialogue (Chapter 12), whose conclusions are that "There is no such thing as general intelligence, and that, if there were, it would be of little use to us in employment work because we are interested in specific abilities or *kinds* of intelligence, and not in degrees of intelligence, *per se.*" The writer of the book believes that the application of psychological tests, in certain cases, makes it possible to discover facts otherwise discoverable only by the costly method of trial and error, but he does not offer them as a general panacea. In his own phrasing: "The scope of psychological tests has been discussed largely from the standpoint of their limitations." To be successful he believes that a test must be—a) carefully selected, b) based upon preliminary experiments upon a large group of workers similarly engaged, c) they must be checked by other and objective standards.

Under Part 2, the author's discussion of Job Analysis and the Vestibule School is clear, practical and to the point, and is in line with the best constructive thinking of the day. Part 3 is more general and theoretical although its brief chapters offer thoughtful reading to the employment manager.

The same comment also holds for the latter chapters of the book under the heading "Conclusions" in Part 4. Probably more theoretical but nevertheless important general principles of employment psychology are here discussed, such as the applicant's point of view, Employment Psychology, and the like. There is a considerable appendix and an index, the former outlining the tests upon which experiments described in the book are based.

Taken as a whole, this is a good book, and one particularly stimulating to the student of its problems. When one realizes the unstandardized and uncharted field that it attempts to cover, one inclines to superlative commendation. Certainly it is neither a text-book nor a book for leisure hours but what it purports to be, it is. Its introducer, Dr. Thorndike, says of it "an honest, impartial account of the use of psychological tests under working conditions in a representative industry." This it is.

In the present temper of the industrial mind, such a book will probably not be thoughtfully read by most of those who should read it—notably the employers of labor. By and large the employer has not yet come to place so high a value upon those who assemble his personnel as he does upon those who assemble his machines. Most employment managers are still clerks. It is also unfortunate, but true, that in times of labor scarcity, employers give anxious thought to these matters, while under conditions of labor surplus, selection is deemed to be easy and elaborate psychological tests only unnecessary frill and refinement.

ELIOTT FROST.

The following books and pamphlets have been received:*

PAUL BOUSFIELD. *The Elements of Practical Psycho-Analysis.* E. P. Dutton & Co., 1920. pp. 276.

A. T. SCHOFIELD, M. D. *The Mind of a Woman.* E. P. Dutton & Co. pp. 116.

W. WHATELY SMITH. *The Foundations of Spiritualism.* E. P. Dutton & Co. New York. pp. 123.

WM. MACPHERSON, D. C. *The Psychology of Persuasion.* E. P. Dutton and Co. New York. pp. 256.

EVELYN DEWEY, EMILY CHILD, BEARDSLEY RUML. *Methods and Results of Testing School Children.* E. P. Dutton & Co. New York. pp. 176.

HENRI PIÈRON. *L'Année Psychologique.* Masson et Cie, Paris. 1920. pp. 547.

J. H. BERKOWITZ. *The Eyesight of School Children.* Washington, Government Printing Office. 1920. pp. 128.

HERMILIO VALDIZAN and HONORIO F. DELGADO. *Revista de Psiquiatria y Disciplinas Conexas.* C. F. Southwell. Lima, Peru. 1920. pp. 103.

DAVID E. BERG. *Personality Culture by College Faculties.* Institute for Public Service. New York City. 1920. pp. 127.

J. ALEXANDER GUNN, M. A. *Bergson and his Philosophy.* E. P. Dutton & Co. New York. pp. 190.

Seventh Annual Conference on Educational Measurements. The Extension Division of Indiana University. 1920. pp. 85.

S. D. PORTEUS. *Condensed Guide to the Binet Tests.* Research Dept. of Training School at Vineland, N. J. 1920. pp. 39.

* Mention here does not preclude further comment.

JAMES SULLY. *My Life and Friends.* E. P. Dutton & Co. New York. pp. 344.

H. L. HOLLINGWORTH. *The Psychology of Functional Neuroses.* D. Appleton and Co. New York. 1920. pp. 259.

KNIGHT DUNLAP. *Mysticism, Freudianism and Scientific Psychology.* C. V. Mosby Co. St. Louis, Mo. 1920. pp. 173.

J. CROSBY CHAPMAN, B. A., Ph. D. *Trade Tests.* Henry Holt & Co. New York. 1921. pp. 435.

DR. J. SADGER, Vienna. *Sleep Walking and Moon Walking.* Nervous and Mental Disease Publishing Co. 1920. pp. 138.

J. B. SEARS. *The Boise Survey.* World Book Co. New York. 1920. pp. 290.

EDWARD J. KEMPF, M. D. *Psychopathology.* C. V. Mosby Co. St. Louis. 1920. pp. 762.

INDEX OF SUBJECTS

(The subject headings of all contributions except Book Reviews and Notes are printed in SMALL CAPITALS.)

Abnormal Psychology (Bridges) 108
ACADEMIC GRADES, CORRELATION WITH ARMY ALPHA TEST 289
ACADEMIC STANDING AND INTELLIGENCE STANDING 361
Adolescence, Education During (Mackie) 279
ALTERNATIVE INTELLIGENCE EXAMINATIONS, EQUALITY IN DIFFICULTY OF 283
ANALOGIES, STANDARDIZATION AND WEIGHTING OF 263
ANTICLIMAX AND CLIMAX OF PRESENTATION ON MEMORY, EFFECT OF 330
APPLIED PSYCHOLOGY OF NAMES 348
ARMY ALPHA INTELLIGENCE TEST CORRELATION WITH ACADEMIC GRADES 289
ARMY PROMOTION, PROPHESYING OF 73
ARMY TESTS, SOME RESULTS AND INFERENCES DERIVED FROM USE OF 59

Brightness and Dullness in Children (Woodrow) 279

CLIMAX AND ANTICLIMAX, EFFECT OF ORDER OF PRESENTATION ON MEMORY 330
CLINICAL PSYCHOLOGY AND THE DEGREE OF PH. D. 88
CLINICAL STUDY AS METHOD IN EXPERIMENTAL EDUCATION 126
CO-EFFICIENTS OF CORRELATION BY RANK DIFFERENCE METHOD, TABLES OF 115
COLLEGE GRADUATES, PSYCHOLOGICAL EXAMINING IN SOCIAL SERVICE AND EDUCATION BY 207
COLLEGE WOMEN, PSYCHOLOGICAL TESTS AS DIAGNOSTIC VOCATIONAL APTITUDES IN 30
COLORED AND WHITE COLLEGE STUDENTS, STUDY OF, BY STANFORD BINET SCALE 316
COMMON SYNAESTHESIA OF MUSIC 342
COMPLETION, PICTURE 310
COMPLETION TEST, COMPARISON OF TWO METHODS OF GIVING NUMBER SERIES 346
CONSTANT ERROR IN PSYCHOLOGICAL RATINGS 25
CORRELATION, ARMY ALPHA AND ACADEMIC GRADES, 289; BY RANK DIFFERENCE METHOD, TABLES OF 115

DECISION STUDY OF YOUNG MEN AND WOMEN 364
Dullness and, Brightness in Children (Woodrow) 279

Education during Adolescence (Mackie) 279
EDUCATION, CLINICAL STUDY AS A METHOD IN EXPERIMENTAL, 126; PSYCHOLOGICAL EXAMINING BY COLLEGE GRADUATES IN 207
EFFECTS OF VARIOUS MODES OF PUBLIC READING 162
EMOTIONS, FIRST REVISION GROUP SCALE FOR INVESTIGATING 97
Employment Psychology (Link) 375
EMPLOYMENT PSYCHOLOGY, FURTHER DEVELOPMENT OF, 306; IN PUBLIC INDUSTRY 1
ENVIRONMENT, EFFECT OF POOR, ON TESTS OF INTELLIGENCE 91

EXAMINATIONS, EQUALITY IN DIFFICULTY OF ALTERNATIVE INTELLIGENCE 283
EXPERIMENTAL EDUCATION, CLINICAL STUDY AS A METHOD OF 126

Factory Labor, Turnover of (Slichter) 278
FATIGUE, RACIAL DIFFERENCES IN 235
FEEBLEMINDED NEGRO, PHENOMENAL MEMORIZING BY 202

GENERAL INTELLIGENCE, DETERMINED BY WEAKEST ESSENTIAL ELEMENT 155
GROUP SCALE, FOR INVESTIGATING EMOTIONS, FIRST REVISION, TENTATIVE NORMS 97
Guide for Stanford Revision Binet-Simon Intelligence Tests (Terman) 281

Health, Towards Racial (March) 276

INADEQUATE SCHOOLING, EFFECT OF, ON RESULTS OF TESTS OF INTELLIGENCE 91
Industrial Education (Dooley) 110
INDUSTRY, A NEW APPLICATION OF PSYCHOLOGY TO, 245; WHAT IT WANTS AND DOES NOT WANT FROM PSYCHOLOGISTS 18
INFLUENCE OF (a) INADEQUATE SCHOOLING (b) POOR ENVIRONMENT ON RESULTS OF TESTS OF INTELLIGENCE 91
INTELLIGENCE, GENERAL, AS DETERMINED BY WEAKEST ESSENTIAL ELEMENT, 155; INTELLIGENCE AND SENESCENCE, 219; EXAMINATIONS, EQUALITY IN DIFFICULTY OF, 283; TESTS AND ACADEMIC STANDING, 361; TESTS, INADEQUATE SCHOOLING AND POOR ENVIRONMENT, 91; OF WHITE AND COLORED STUDENTS BY STANFORD REVISION OF BINET 316

LABOR, TURNOVER OF FACTORY 278
LEARNING TEST, TENTATIVE NORMS IN RATIONAL 250

Management, Psychology of (Gilbreth) 274
MEASUREMENT, SHORT POINT SCALE FOR MENTAL 258
Measuring Results of Teaching (Monroe) 281
MEMORIZING, PHENOMENAL, BY FEEBLEMINDED NEGRO 202
MEMORY, EFFECT OF CLIMAX AND ANTICLIMAX ORDER OF PRESENTATION ON 330
MEMORY TESTS, SIGNIFICANT RESPONSES IN CERTAIN 142
MENTAL FATIGUE, RACIAL DIFFERENCES IN, 235; MEASUREMENT, SHORT POINT SCALE FOR, 258; TESTS, APPLICABILITY OF, TO PERSONS OVER FIFTY YEARS OF AGE, 39; TESTS AND SELECTION OF MILL WORKERS, 339
METHOD IN EXPERIMENTAL EDUCATION, CLINICAL STUDY AS A 126
MILL WORKERS, SELECTION BY MENTAL TESTS 339
MINOR STUDIES, PSYCHOLOGICAL LABORATORY, INDIANA UNIVERSITY 91
MUSIC, COMMON SYNAESTHESIA OF 342
Musical Talent, Psychology of (Seashore) 105

Nationality and Internationalism, Psychology of (Pillsbury) 274
NEGRO, CASE OF PHENOMENAL MEMORIZING BY FEEBLEMINDED 202
NAMES, APPLIED PSYCHOLOGY OF 348
NORMS, TENTATIVE, GROUP SCALE FOR INVESTIGATING EMOTIONS, 97; TENTATIVE IN RATIONAL LEARNING TEST 250
Notes and News: National Academy of Science, 113; National Research Council, 113; State Psychiatric Clinic of New Jersey, 113; Work of Psychologists on Job-Analysis, Man-Analysis and coordination of these 113, 114

NUMBER SERIES COMPLETION TEST, COMPARISON OF TWO METHODS OF GIVING 346
PICTURE COMPLETION TEST 310
POINT SCALE, SHORT, FOR MENTAL MEASUREMENT 258
PROPHESYING ARMY PROMOTION 73
Psychical Science (Crawford) 280
Psychoanalysis, History, Theory, Practice (Tridon) 277
PSYCHOLOGICAL EXAMINING IN SOCIAL SERVICE AND EDUCATION, 207; RATINGS, CONSTANT ERROR IN, 25; TESTS AS DIAGNOSTIC OF VOCATIONAL APTITUDES IN COLLEGE WOMEN 30
PSYCHOLOGISTS, WHAT INDUSTRY WANTS AND DOES NOT WANT FROM 18
PSYCHOLOGY, APPLIED, OF NAMES, 348; BAKE BREAD, SHOULD, 294; FURTHER DEVELOPMENT OF EMPLOYMENT, 306; of Management (Gilbreth), 274; of Musical Talent (Seashore), 105; of Nationality and Internationalism (Pillsbury), 274; NEW APPLICATION OF, TO INDUSTRY 245
Racial Differences in Mental Fatigue, 235; Health (March) 276
RANK DIFFERENCE METHOD, TABLES 115
RATINGS, CONSTANT ERROR IN PSYCHOLOGICAL 25
RESULTS AND INFERENCES, DERIVED FROM USE OF ARMY TESTS AT UNIVERSITY OF MINNESOTA 59
SCALE FOR INVESTIGATING OF EMOTIONS, FIRST REVISION TENTATIVE NORMS, 97; FOR MENTAL MEASUREMENT, SHORT POINT 258
School Statistics and Publicity (Alexander) 109
SELECTION OF MILL WORKERS BY MENTAL TESTS, 339; VOCATIONAL, FOR SPECIALIZED TASKS 186
SOCIAL SERVICE WORK, PSYCHOLOGICAL EXAMINING BY COLLEGE GRADUATES IN 207
STANDARDIZATION, AND WEIGHTING OF 200 ANALOGIES 263
STANFORD REVISION OF BINET-SIMON SCALE WITH WHITE AND COLORED COLLEGE STUDENTS, RESULTS OF 316
SENESCENCE AND INTELLIGENCE 219
SYNAESTHESIA, COMMON, OF MUSIC 342

TABLES TO FACILITATE COMPUTATION OF COEFFICIENTS OF CORRELATION BY RANK DIFFERENCE METHOD 115
Talent, Psychology of Musical (Seashore) 105
TASKS, VOCATIONAL SELECTION FOR SPECIALIZED 186
Teaching, Measuring Results of (Monroe) 281
TESTS, ACADEMIC STANDING AND INTELLIGENCE, 361; DIAGNOSTIC, OF VOCATIONAL APTITUDES IN COLLEGE WOMEN, 30; INTELLIGENCE, INADEQUATE SCHOOLING AND POOR ENVIRONMENT, 91; NORMS IN RATIONAL LEARNING, 250; NUMBER SERIES COMPLETION, COMPARISON OF TWO METHODS OF GIVING, 346; SELECTION OF MILL WORKERS BY MENTAL, 339; SIGNIFICANT RESPONSES IN CERTAIN MEMORY 142
Turnover of Factory Labor (Slichter) 278

VOCATIONAL APTITUDES, IN COLLEGE WOMEN 30
VOCATIONAL SELECTION FOR SPECIALIZED TASKS 186

WEIGHTING AND STANDARDIZATION OF 200 ANALOGIES 263
WHITE AND COLORED COLLEGE STUDENTS, COMPARATIVE INTELLIGENCE OF, BY STANFORD BINET SCALE 316
WORKERS, MILL, SELECTION BY MENTAL TESTS 339

INDEX OF AUTHORS

(The names of authors of original contributions are printed in SMALL CAPITALS.)

ADAMS, HENRY FOSTER 330
Alexander, Carter 109
ANDERSON, JOHN E. 346
ARPS, G. F. 289

BAKER, H. J. 361
BARRETT, MYRON F. 278
BATES, MARJORY 108
BAXTER, MILDRED FRANCES 207
BEESON, M. F. 219
BLANCHARD, PHYLLIS 276, 277
BRIDGES, JAMES W. 108, 258
BURTT, H. E. 1, 289
BYRD, HIRAM 202

CHAMBERS, O. R. 97
COE, GEORGE ALLEN 109
Crawford, W. J. 280

DERRICK, S. M. 316
DOLL, EDGAR A. 88
Dooley, William H. 110

FOSTER, JOSEPHINE CURTIS 39, 142
FREEMAN, FRANK N. 126
FROST, ELIOTT 18, 294, 375

GARTH, THOMAS R. 235
GAULT, ROBERT H 310
GEISSLER, L. R. 279, 280, 281
GIBSON, SYBIL MARSH 364
Gilbreth, L. M. 274
GORDON, EDNA 361
GROETZINGER, MARIE 348

IRLE, K. W. 73

KOHS, S. C. 73

LI, CHI 274
LINK, HENRY C. 245, 306

Mackie, Ransom A. 279
March, Norah H. 276
MARCUS, LAWRENCE 186
MILLIKEN, HARRY E. 110
Monroe, Walter Scott 281
MOORE, BRUCE V. 155
MUDGE, E. LEIGH 342
MURRAY, ELSIE 30

OGDEN, R. M. 105
OTIS, ARTHUR S. 339

PETERSON, JOSEPH 250
Pillsbury, W. B. 274
PINTNER, RUDOLPH 263
PRESSEY, LUELLA WINIFRED 91
PRESSEY, S. L. 97

REEDY, ESTHER 258
RENSHAW, SAMUEL 263
ROBACK, A. A. 348

Seashore, C. E. 105
Slichter, Summer H. 278
SPROWLS, J. W. 274

TAYLOR, GRACE A. 39
Terman, Lewis M. 281
THORNDIKE, EDWARD L. 25, 283
Tridon, André 277

VAN WAGENEN, M. J. 59
Woodrow, Herbert 279
WOOLBERT, CHARLES H. 162

Directory of American Psychological Periodicals

American Journal of Psychology—Ithaca, N. Y.: Morrill Hall.
Subscription $6.50. 600 pages annually. Edited by Edward Bradford Titchener. Quarterly. General and experimental psychology. Founded 1887.

Pedagogical Seminary—Worcester, Mass.: Mary McLoughlin.
Subscription $5. 500 pages annually. Edited by G. Stanley Hall. Quarterly. Pedagogy and educational psychology. Founded 1891.

Psychological Review—Princeton, N. J.: Psychological Review Company.
Subscription $4.25. 480 pages annually.
Bi-monthly. General. Founded 1894. Edited by Howard C. Warren.

Psychological Bulletin—Princeton, N. J.: Psychological Review Company.
Subscription $5. 720 pages annually. Psychological literature.
Monthly. Founded 1904. Edited by Shepherd I. Franz.

Psychological Monographs—Princeton, N. J.: Psychological Review Company.
Subscription $5.50 per vol. 500 pp. Founded 1895. Ed. by James R. Angell.
Published without fixed dates, each issue one or more researches.

Psychological Index—Princeton, N. J.: Psychological Review Company.
Subscription $1.50. 200 pp. Founded 1895. Edited by Madison Bentley.
An annual bibliography of psychological literature.

Journal of Philosophy, Psychology, and Scientific Methods—New York. Sub-station 84. Bi-weekly. 728 pages per volume. Founded 1904.
Subscription $4. Edited by F. J. E. Woodbridge and Wendell T. Bush.

Archives of Psychology—Sub-station 84, N. Y.: Archives of Psychology.
Subscription $5. 600 pp. ann. Founded 1906. Ed. by R. S. Woodworth.
Published without fixed dates, each number a single experimental study.

Journal of Abnormal Psychology—Boston: Richard G. Badger.
Subscription $5. 480 pages annually. Edited by Morton Prince.
Bi-monthly. Founded 1906. Entire field of abnormal psychology.

Psychological Clinic—Philadelphia: Psychological Clinic Press.
Subscription $2.50. 288 pages ann. Ed. by Lightner Witmer. Founded 1907.
Without fixed dates (9 numbers). Orthogenics, psychology, hygiene.

Training School Bulletin—Vineland, N. J.: The Training School.
Subscription $1. 160 pp. ann. Ed. by E. R. Johnstone. Founded 1904.
Monthly (10 numbers). Psychology and training of defectives.

Journal of Educational Psychology—Baltimore: Warwick & York.
Subscription $4. 600 pages annually. Founded 1910. Monthly (10 numbers). Chairman, Harold Ordway Rugg. (Educational Psychology Monographs. Edited by Guy M. Whipple. Published separately at varying prices. Same publishers.)

The Behavior Monographs—Cambridge, Mass.: Emerson Hall.
Subscription $5. 450 pages per volume. Edited by John B. Watson.
Published without fixed dates, each number a single research.

Psychoanalytic Review—Washington, D. C.: 3617 10th St., N. W.
Subscription $6. 500 pages annually. Psychoanalysis.
Quarterly. Founded 1913. Ed. by W. A. White and S. E. Jelliffe.

Journal of Experimental Psychology—Princeton, N. J.:
Psychological Review Company. 480 pages annually. Experimental.
Subscription $4.25. Founded 1916. Bi-monthly. Ed. by John B. Watson.

Journal of Applied Psychology—Worcester, Mass: Florence Chandler.
Subscription $4. 400 pages annually. Quarterly. Founded 1917. Edited by James P. Porter.

The Journal of Comparative Psychology—Baltimore: Williams & Wilkins Co.
Subscription $5. 500 pages (approximately) per volume.
Bi-monthly. Edited by Knight Dunlap and Robert M. Yerkes. Founded 1921.

Journal of International Relations—Worcester, Mass.: Louis N. Wilson.
Subscription $3. 500 pages annually. Founded 1910. Quarterly. Edited by George H. Blakeslee and Harry E. Barnes, assisted by a Board of some 25 contributing editors.

The Brandow Printing Company
Albany, N. Y.